APPROVED FOR WATER
SECTION ONLY

PROPOSAL

CONTRACT DOCUMENTS, AND CONSTRUCTION SPECIFICATIONS

for constructing

WATER WORKS IMPROVEMENTS

for

THE CITY OF ATHENS, GEORGIA

DIVISION ONE AND TWO

Upshaw C. Bentley, Jr., Mayor

City Council

W. Calvin Bridges
Robert H. Carson
Dwain P. Chambers
Bryan C. Craft
George M. Hester

Robert H. Kimbrell
Wallace E. Reeves
Lewis Shropshire, Jr.
John E. Taylor
Edward L. Turner

APPROVED
STATE OF GEORGIA
WATER SUPPLY SECTION
OCT 12 1976
ENVIRONMENTAL PROTECTION DIVISION
By Edward Urbain

William T. Cook - Administrative Assistant
H. L. Pittard - City Engineer
Joseph J. Gaines - City Attorney

Financed Through
Department of Housing and Urban Development
Community Development Block Grant
No. B-75-HN-13-0003

76 111

WIEDEMAN AND SINGLETON
ENGINEERS
ATLANTA, GEORGIA

August, 1976

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ADVERTISEMENT FOR BIDS

FOR

WATER WORKS IMPROVEMENTS

CITY OF ATHENS, GEORGIA

Separate sealed Proposals for Water Works Improvements will be received by the City of Athens, Georgia at the City Hall until 2:00 P.M., Local Time, December 2, 1976, at which time and place they will be publicly opened and read.

Work to be Done: The work to be done consists of the following divisions of work:

DIVISION ONE - Construction of approximately 9,600 feet of 36-inch, 14,100 feet of 20-inch, and 5,300 feet of 16-inch water lines, including railroad and highway crossings, valves and connections to the existing system. Proposals will be received on both prestressed concrete and ductile iron pipe.

DIVISION TWO - Construction of 16 MGD filtration plant additions, consisting principally of flocculation and settling basins, filters, chlorination and chemical feed facilities, instrumentation and other associated work.

Plans, Specifications and Contract Documents: Plans, Specifications and Contract Documents may be examined at Wiedeman and Singleton, Engineers, 1789 Peachtree Road, N. E., Atlanta, Georgia, Atlanta Builders Exchange, Atlanta, Georgia, F. W. Dodge Plan Room, Atlanta, Georgia, and the City Hall, Athens, Georgia.

Plans and specifications may be obtained from Wiedeman and Singleton, Engineers, 1789 Peachtree Road, N. E., Atlanta, Georgia 30309, for the following deposit:

Division one Plans	$ 30.00
Division Two Plans	115.00
Specifications for Divisions One and Two	30.00

Upon return of all documents in undamaged condition within thirty (30) days after the date of opening of bids, one-half of the amount of deposit will be refunded. No refunds will be made for plans and documents returned after thirty (30) days.

Bid Bond: All Proposals must be accompanied by a certified check or a bid bond of a reputable bonding company authorized to do business in the State of Georgia, in the amount equal to at least ten per cent (10%) of the Bid. Upon the proper execution of the agreement and required bonds, the check or bid bonds will be returned to all bidders.

Performance and Payment Bonds: A contract performance bond and payment bond, each in an amount equal to one hundred per cent (100%) of the agreement amount, will be required of the successful bidder.

Withdrawal of Bids: No submitted bid may be withdrawn for a period of sixty (60) days after the scheduled closing time for the receipt of bids.

Acceptance or Rejection of Bids: The right is reserved to accept or reject any or all bids and to waive informalities.

Wage Schedule: The schedule of minimum hourly rates of wages required to be paid to the various laborers and mechanics employed directly upon the site of the work, as determined by the Secretary of the U. S. Department of Labor, will be issued by addendum.

THIS PROJECT WILL BE FINANCED BY A GRANT FROM THE U. S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, COMMUNITY DEVELOPMENT PROGRAM.

CITY OF ATHENS, GEORGIA

By: Upshaw C. Bentley, Jr.
Mayor

WIEDEMAN AND SINGLETON
ENGINEERS
ATLANTA, GEORGIA

August, 1976

INSTRUCTIONS TO BIDDERS
AND
SPECIAL PROVISIONS

1. Intention: It is intended that the Instructions to Bidders and Special Provisions, General Conditions, Detailed Specifications, and contract Drawings shall provide for the complete work to which they relate.

2. Definitions: Where the following words or pronouns used in their stead occur herein, they shall have the following meaning:

"OWNER" shall mean the City of Athens, Georgia, party of the second part, to the following agreement, or their duly authorized and legal representative.

"ENGINEER" shall mean Wiedeman and Singleton, Engineers, of Atlanta, Georgia, acting for the Owner or their duly authorized representatives.

"CONTRACTOR" shall mean the party of the first part to the following agreement, or the legal authorized representatives of such party.

3. Work to be Done: The work to be done consists of furnishing all materials and equipment and performing all labor necessary for constructing Water Works Improvements as set forth in the Proposal Form, as shown on the Drawings, and as specified.

The work is separated into two divisions. The Owner reserves the right to award each division within sixty (60) days after the scheduled closing time for receipt of bids, at the amount bid in the Proposal.

The two divisions of work are as follows:

DIVISION I - Consists of furnishing all materials and equipment and performing all labor necessary to install water distribution lines, including railroad crossings, valves, connections to existing system and all other work shown on the Drawings and/or specified.

DIVISION II - Consists of furnishing all materials and equipment and performing all labor necessary for constructing new filters, flocculation basins and sedimentation basins, complete, including grading, excavation, backfill, concrete work, masonry work, flocculation equipment, interior and exterior piping, mechanical work, electrical work, metering, instrumentation and control work, heating, ventilating, etc. to the limits shown on the Drawings and/or specified.

4. Site Examination: The Bidder is expected and requested to examine the location of the work and to inform himself fully as to the structural and mechanical conditions; the conformation of the ground; the character, quality and quantity of the materials to be encountered; the character of equipment and facilities needed preliminary to and during the prosecution of the work; the general and local conditions and all other matters which can in any way affect the work to be done under the contract.

5. Drawings: The character and location of the work, together with the essential details, are shown upon a set of Drawings entitled:

City of Athens, Georgia
Water Works Improvements
DIVISION (ONE OR TWO)
August 1976

The Drawings and the Specifications shall form a part of the Contract for the work. The approved plans will be supplemented by such working drawings as are necessary. All authorized alterations affecting the requirements and information given on the approved plans shall be in writing.

6. Working Drawings: Working drawings shall consist of such detail drawings as may be required for prosecution of the work, but not included in the Contract Drawings. All necessary working drawings for construction of the steel roofs shall be furnished by the Contractor. Working drawings shall include shop details, size and thickness of plates and principal members, and all other such working drawings as may be required by the Specifications, and as necessary for successful completion of the work. Approval by the Engineer must be obtained before any work involving these drawings may be performed.

(a) Check by Contractor: The Contractor shall check all shop drawings and working drawings for accuracy of dimensions and details, and for conformance with Contract Drawings and Specifications, before submitting such drawings to the Engineer for approval. The Contractor shall indicate that shop and working drawings have been checked by an appropriate stamp or notation on the face of the drawings.

(b) Responsibility for Accuracy: Approval by the Engineer of the Contractor's working drawings does not relieve the Contractor for accuracy of dimensions and details. The Contractor shall be responsible for agreement and conformity of the working drawings with the Contract Drawings and Specifications.

(c) Payment: The Contract price shall include the cost of furnishing all working drawings, and the Contractor shall be allowed no extra compensation for furnishing such working drawings.

7. Cooperation of Contractor: The Contractor will be supplied with five (5) copies of the Plans and Specifications. The Contractor shall have available on the work, at all times, one (1) copy of each of said Plans and Specifications. He shall give the work the constant attention necessary to facilitate progress thereof and shall cooperate with Engineer and other contractors in every way possible. Contractor shall at all times have a Superintendent, satisfactory to the Engineer, capable of acting as his agent on the work, who shall receive instructions from the Engineer or his authorized representatives. The Superintendent shall have full authority to execute the orders or directions of the Engineer without delay and to promptly supply such materials, tools, equipment and labor as may be required.

8. Order of Work. The Contractor shall schedule work that requires facilities to be removed from service to fit water system operations. Such work may require overtime or weekend work. The Contractor shall coordinate all construction operations with Water Works personnel and shall develop acceptable schedules. The Contractor will be required to conduct all work in such a manner

as will least interfere with operations of traffic and existing facilities. All construction operations which have the effect of restricting the operation of existing water producing facilities shall be subject to the prior approval of the Owner as to time and manner in which the work is to be done.

9. Proposals: All Proposals must be made on the Proposal forms included herein and shall be for materials and work shown on the Drawings and/or specified. Proposal forms shall not be detached from these Specifications. Proposals are to be enclosed in a sealed envelope addressed to the Mayor and Council of the City of Athens, Georgia, and shall be labeled "Proposal: Water Works Improvements, DIVISION (I or II), Athens, Georgia".

If forwarded by mail, the sealed envelope containing the Proposal must be enclosed in another envelope addressed as specified.

(a) Unit Price Items: The itemized quantities given in the Proposal as unit price work shall be considered by the Contractor as the quantities required to complete the work. Should the actual quantities required in the construction of the work be greater than or less than the quantities shown in the items, an amount equal to the difference in quantities at the unit prices bid for the items will be added to or deducted from the total contract amount.

(b) Lump Sum Prices: Where itemized prices are not given in the Proposal, the work shown on the Drawings or specified shall be considered by the Contractor to be sufficient for completion of his contract for the lump sum prices bid. Should the actual quantities required for construction be greater than or less than the work shown on the Drawings, or specified, an amount equal to the difference in quantities at the unit prices bid for authorized changes in work will be added to or deducted from the Contract price, as described in Paragraph 10, below.

(c) Total Amount Bid: The correct total amount bid is defined as the correct sum total of amounts bid for the items in the Proposal. The correct amount bid for each unit price item is defined as the correct product of the quantity listed in the Proposal for the item, multiplied by the unit price bid.

10. Extra Work Items in Proposal: The Proposal contains certain unit price items entitled "Extra Work if Ordered by Engineer". In each such item the estimated quantity is based upon the average amount of extra work encountered in a typical job. The stated quantities are not guaranteed, but are included in the Proposal in order to determine in advance of construction the actual low bidder. No work included in such items will be authorized for payment without advance authorization by the Engineer.

11. Time of Completion and Liquidated Damages: The time allowed for completion of all work to be done under this contract shall be computed from the date specified in the notification of the Engineer to proceed with the work and shall be as stated in the Proposal and Construction Agreement. Time is of the essence of this Contract, and the Contractor shall pay to the Owner, not as a penalty, but as liquidated damages, the sum of one hundred dollars ($100.00) for each calendar day that he shall be in default of completing all the work within the time limit named herein. Such notification will be issued upon completion of the Contract Agreement, and in accordance with approved construction schedule, arranged to be within the Contract time for completion.

12. Bid Security: Each Proposal must be accompanied by a certified check or by a bid bond for an amount equal to at least 10% of the amount of the bid, to guarantee that the successful bidder will, within ten (10) days from the date of the notice of award of Contract, enter into a Contract with the Owner, and execute the said Owner a Performance Bond and Payment Bond, the said Contract and bonds to be in the form set forth in the Contract, Bond and Specifications referred to in said Advertisement for Bids. If for any reason whatever, the Bidder withdraws from the competition after opening the bids, or refuses to execute the required Contract, Performance and Payment Bond, if his Bid is accepted, the Owner may retain the amount of the certified check, or proceed on the Bid Bond. The Surety on the Contract Performance Bond and the Payment Bond shall be a surety company authorized to do business in the State of Georgia, Clarke County. Said bond and surety shall be subject to approval by the Attorney for the Owner, and shall be signed by an agent of the surety who is a resident of Clarke County.

13. Insurance Coverage: The Bidders' attention is directed to the fact that the Contractor will be required to secure insurance of the type, and of the amounts, described in the General Conditions.

14. Bids Opened in Public: Bidders are requested to be present at the opening of Proposals, which will be in public.

15. Telegraphic Modification: Any bidder may modify his bid by telegraphic communication at any time prior to the scheduled closing time for receipt of bids, provided such telegraphic communication is received by the Owner prior to the closing time, and provided, further, the Owner is satisfied that a written confirmation of the telegraphic modification over the signature of the bidder was mailed prior to the closing time. The telegraphic communication should not reveal the bid price but should provide the addition or subtraction or other modification so that final prices or terms will not be known by the Owner until the sealed bid is opened. If written confirmation is not received within two days from the closing time, no consideration will be given to the telegraphic modification.

16. Right to Reject Bids: The Owner reserves the right to reject any or all bids and to waive informalities. No bids will be received after the time set for opening Proposals. Any unauthorized conditions, limitations or provisos attached to the Proposal, except as provided herein, will render it informal and may cause its rejection. Unbalanced bids will be subject to rejection. Any bidder may withdraw his bid, either personally or by telegraphic or written request, at any time prior to the scheduled closing time for receipt of bids.

17. Determination of Low Bid: The Contract will be awarded, if it is awarded, to the lowest responsible bidder or bidders. The Owner will decide which is the lowest responsible bidder, and in determining such bidder, the following elements are to be considered: whether the bidder involved (a) maintains a permanent place of business; (b) has adequate plant equipment to do the work properly and expeditiously; (c) has a suitable financial status to meet obligations incident to the work; and (d) has appropriate technical experience on similar type of work and scope.

18. Return of Bid Security: The Owner will, within ten (10) days following the opening of bids, return the certified check or bid bond of all bidders, except the checks or bonds posted by the three lowest bidders, and upon the final award and execution of Contract the remaining checks and bonds will be promptly returned.

19. Interpretation of Plans and Specifications: If any person contemplating submitting a bid for the proposed contract is in doubt as to the true meaning of any part of the Plans, Specifications, or other proposed Contract Documents, or as to the scope of any part of the work, he shall submit to the Engineer a written request for an interpretation thereof. The person submitting the request will be responsible for its proper delivery in ample time for an interpretation to be issued not later than three (3) days prior to the letting date. Any interpretation of the proposed documents will be made only by Addendum duly issued and a copy of such Addendum will be mailed or delivered to each person receiving a set of such documents. The Engineer will not be responsible for any other interpretations of the proposed documents.

20. Complete Work Required: The Specifications, the Plans, and all Supplementary Documents are essential parts of the Contract, and requirements occurring in one are as binding as though occurring in all. They are intended to be cooperative, to describe and provide for a complete work. In case of discrepancy in the Plans, figured dimensions shall govern. In case of omissions from the Specifications, as to items of equipment and materials or quantities therefor, the Plans shall govern. It shall be the responsibility of the Bidder to call to the attention of the Engineer obvious omissions of such magnitude as to affect the strength, adequacy, function, completeness, or cost of any part of the work in ample time for amendment by Addendum prior to letting date.

21. Construction Stakes: Subsidiary lines and grades shall be laid out by the Contractor from the controlling lines and bench marks furnished by the Engineer or from measurements shown on the Drawings. All lines and grades shall be subject to checking by the Engineer, but this checking shall in no wise relieve the Contractor from responsibility for their correctness.

The Contractor shall provide such stakes, materials, and such labor and assistance as the Engineer may require in laying out work, establishing bench marks and checking and measuring the work.

22. Authority and Duties of Inspector: Inspectors shall be authorized to inspect all work done and all materials furnished, including preparation, fabrication and manufacture of the materials to be used. The Inspector shall not be authorized to alter or waive any requirements of the Specifications. He shall call the attention of the Contractor to any failure of the work or materials to conform to the Specifications and Contract. He may reject materials or suspend the work until any questions at issue can be referred to and decided by the Engineer.

The presence of the Inspector shall in no wise lessen the responsibility of the Contractor.

23. Inspection: The Contractor shall furnish the Engineer with every reasonable facility for ascertaining whether or not the work performed and materials used are in accordance with the requirements and intent of the Specifications and Contract. No work shall be done or materials used without suitable supervision or inspection by the Engineer or his representative. Failure to reject any defective work or materials shall not in any way prevent later rejection when such defect is discovered, or obligate the Owner to final acceptance.

24. Defective Work and Material: The inspection of the work shall not relieve the Contractor of any of his obligations to fulfill the Contract and defective work shall be made good, notwithstanding that such work and materials have been

previously inspected by the Engineer and accepted or estimated for payment. The failure of the Engineer to condemn improper materials or workmanship shall not be considered as a waiver of any defect which may be discovered later, or as preventing the Owner at any time subsequently from recovering damages for work actually defective. All work shall be guaranteed against defects in workmanship or material for a period of one year from the date of final acceptance.

25. Rejection of Work and Materials: All materials furnished and work done when not in accordance with the Specifications and Contract, will be rejected and shall immediately be removed and other work done and materials furnished in accordance therewith. If the Contractor fails to remove the work and materials as above ordered, within forty-eight hours, then the Engineer shall have the right and authority to stop the Contractor and his work at once and to supply men and material at the cost and expense of the Contractor to remove said work and materials.

26. Corrections: Should any portions of the Plans and Specifications be obscure or in dispute, they shall be referred to the Engineer and he shall decide as to the true meaning and intent. He shall also have the right to correct any errors or omissions at any time when such corrections are necessary for the proper fulfillment of said Plans and Specifications.

27. Disagreement: Should any disagreement or difference arise as to the estimate, quantities or classifications, or as to the meaning of the Drawings or Specifications, or any point concerning the character, acceptability, and nature of the several kinds of work, any materials and construction thereof, the decision of the Engineer shall be final and conclusive and binding upon all parties to the Contract.

28. Weather: During unseasonable weather, all work must stop when the Engineer so directs and all work must be suitably protected.

29. Right-of-Way: The necessary land for the construction of the work will be furnished by the Owner. All operations shall be confined to the assigned area. The Owner will provide no right-of-way over other property. The Contractor shall take every possible precaution to inconvenience as little as possible the owners or tenants of adjacent property. Public highways shall not be obstructed in such a way as to cut off traffic. The Contractor shall, at his own expense, repair any damage or injury to either public or private property during the progress of the work.

The Contractor shall confine all construction activities within rights-of-way obtained by the Owner. In roadways and streets, existing right-of-way limits shall be observed. Wholesale cutting of trees will not be permitted. The Contractor shall preserve as many trees as possible.

30. Competent Labor: The Contractor shall employ only competent and skilled men on the work. The Contractor shall have a competent Superintendent or Foreman present at all times when the work is in progress with authority to receive orders and execute the work.

The Contractor shall, upon demand from the Engineer, immediately remove any Superintendent, Foreman or workman whom the Engineer may consider incompetent or undesirable.

31. Contractor's Availability: The Contractor shall have a responsible

representative on call at all times. The Contractor will also maintain a crew with necessary tools and equipment available on call after normal working hours, on weekends during inclement weather and other times when work is not in progress to perform any necessary emergency repair work which may occur as a result of the work under this Contract.

32. Laws and Regulations: The Contractor shall keep himself fully informed of all laws, ordinances and regulations of State, City and County in any manner affecting those engaged or employed in the work, or the materials used in the work, or in any way affecting the conduct of the work, and of all orders and decrees of bodies or tribunals having any jurisdiction or authority over same. If any discrepancy or inconsistency should be discovered in this Contract, or in the Drawings or Specifications herein referred to, in relation to any such law, ordinance, regulation, order or decree, he shall forthwith report the same in writing to the Owner. He shall at all times, himself observe and comply with all such existing and future laws, ordinances and regulations, and shall protect and indemnify the Owner and its agents against any claims or liability arising from or based on the violation of any such law, ordinance, regulation, order or decree, whether by himself or by his employees.

33. Protective Work: The Contractor shall furnish and install all necessary temporary works for the protection of the work, including barricades, warning signs, and lights at night.

34. Safety Regulations: The performance of the work under this Contract shall comply with safety regulations prescribed by the Owner. Each bidder shall satisfy himself as to the character and extent of such regulations.

35. Sanitary Regulations: Necessary sanitary conveniences for the use of the laborers on the work shall be erected and maintained by the Contractor, in such a manner and at such points as shall be approved by the Engineer. Their use shall be strictly enforced.

36. Shanties: Should the Contractor so desire, he may build shanties or other structures for housing tools, machinery and supplies, but they will be permitted only at approved places, and their surroundings shall be maintained at all times in a sanitary and satisfactory manner. On or before the completion of the work, all such structures shall be removed, together with all rubbish and trash, at the expense of the Contractor.

37. Office Space and Facilities for Inspectors: The Contractor shall furnish proper and adequate office space and facilities for the use of the Resident Engineer and inspectors. A room shall be provided at least 12' x 14' either in connection with the Contractor's office or in a separate structure, equipped with lights, heat, air conditioning, telephone, desk, chair, file cabinet, plan rack and plan table.

38. Access Roads: Streets, roads, and drives used by the Contractor for access to and from the site of his work shall be protected from damage in excess of that caused by the normal traffic or vehicles used, or in connection with construction work. Any such damage done shall be repaired immediately and left in good condition at the end of the construction period.

39. Water Supply: The Owner will provide to the Contractor metered water supply at the City's current water rates to the Contractor. The Owner will furnish all water necessary for testing operations. All connections and other means of conducting water must be provided by the Contractor.

40. Power of Attorney: Attorneys-in-fact who sign bid bonds or contract bonds must file with each bond a certified and effectively dated copy of their power of attorney.

41. Georgia State Sales Tax: Bidders shall include in amounts bid in the Proposal an allowance for payment of State Sales Tax on all taxable materials specified to be furnished by the Contractor and incorporated into the work under this Contract.

42. Cleaning Up: Before the work is considered complete, all rubbish and unused material due to, or connected with, the construction shall be removed and the premises left in a condition satisfactory to the Owner. Streets, curbs, crosswalks, pavements, sidewalks, fences, and other public and private property disturbed or damaged shall be restored to their former condition; final payment will be withheld until such work is finished.

43. Non-Discrimination in Employment: Contracts for this work will obligate the Contractor and his subcontractors not to discriminate in employment practices. The Contractor and his subcontractors will be required to comply with the President's Executive Orders No. 11246 and No. 11375. Bidders must, if requested, submit a compliance report concerning their employment practices and policies in order to maintain their eligibility to receive the award of the Contract.

44. Labor Requirements: See Labor Standards Form in these documents. Preference in employment on this Project will, insofar as practicable, be given to qualified local labor.

45. Non-Segregation Facilities Requirements: Bidders must certify that they do not and will not maintain or provide for their employees any facilities that are segregated on a basis of race, color, creed or national origin.

46. Reduction to Proposal: The Owner at his option may deduct any or all 16 inch pipelines at the unit price bid in the Proposal.

47. Alternate Filter System: The Contractor shall bid on two filter systems as described in the Proposal and as shown on the plans. The following is a description of each system and the Contractor is to construct all four filters of one of these alternates.

(a) Alternate "A" - This system includes the use of Precast Wheeler Bottoms, with effluent concrete trough at bottom of slab running along the center of each filter; concrete wash water troughs; 20" effluent pipe connection at filter wall; filter sweeps supports and piping as detailed; the 30" settled water pipe under filter No. 9 will have a center line EL. 83.00 and a filter footing depth of 4'-0"; this system is indicated on the drawings for filters No. 9, 11, 12.

(b) Alternate "B" - This system includes the use of Leopold filter bottoms, with effluent concrete trough at bottom of slab running along the end wall of each filter; fiberglass wash water troughs; 24" effluent pipe connection at filter wall; filter sweeps supports and pipe as detailed; the 30" settled water pipe under filter No. 9 will have a center line EL. 80.83, and a filter footing depth of 6'-2". This system is indicated on the drawings for filter No. 10.

PROPOSAL

TO THE MAYOR AND COUNCIL
CITY OF ATHENS, GEORGIA

Submitted: ______________________, 1976

The undersigned, as Bidder, hereby declares that the only person or persons interested in the Proposal as principal or principals is or are named herein and that no other person than herein mentioned has any interest in this Proposal or in the contract to be entered into; that this Proposal is made without connection with any other person, company or parties making a bid or Proposal; and that it is in full respect fair and in good faith without collusion or fraud.

The Bidder further declares that he has examined the site of the work and informed himself fully in regard to all conditions pertaining to the place where the work is to be done; that he has examined the Plans and Specifications for the work and Contractual Documents relative thereto, and has read all Special Provisions and General Conditions furnished prior to the opening of bids; that he has satisfied himself relative to the work to be performed.

The Bidder proposes and agrees, if this Proposal is accepted, to contract with the City of Athens, Georgia, in the form of contract specified, to furnish all necessary materials, equipment, machinery, tools, apparatus; means of transportation and labor necessary and to complete the construction of the work, in full and complete accordance with the shown, noted, described, and reasonably intended requirements of the Specifications and Contract Documents, to the full and entire satisfaction of the City of Athens, Georgia, with a definite understanding that no money will be allowed for extra work except as set forth in the attached General Conditions and Contract Documents, for the following prices:

DIVISION ONE

WATER SYSTEM IMPROVEMENTS

Item 1 - Ductile Iron, Push-on Joint, or Prestressed Concrete Pipelines: For furnishing and installing ductile iron or prestressed concrete pipelines as shown on the drawings and specified.

a. 9,650 L.F. 36" ductile iron pipeline, 0' - 5' cover -

@ $________________ L.F. Total $_______________

b. 9,650 L.F. 36" prestressed concrete pipeline, 0' - 5' cover -

@ $________________ L.F. Total $_______________

Item 2 - Ductile Iron, Push-on Joint, or Prestressed Concrete Pipelines: For furnishing and installing ductile iron or prestressed concrete pipelines as shown on the drawings and specified.

a. 54 L.F. 24" ductile iron pipeline, 0' - 5' cover -

@ $________________ L.F. Total $_______________

b. 54 L.F. 24" prestressed concrete pipeline, 0' - 5' cover -

@ $________________ L.F. Total $_______________

c. 14,124 L.F. 20" ductile iron pipeline, 0' - 5' cover -

@ $________________ L.F. Total $_______________

d. 14,124 L.F. 20" prestressed concrete pipeline, 0' - 5' cover -

@ $________________ L.F. Total $_______________

Item 3 - Ductile Iron, Push-on Joint, or Prestressed Concrete Pipelines: For furnishing and installing ductile iron or prestressed concrete pipelines as shown on the drawings and specified.

a. 4,975 L.F. 16" ductile iron pipeline, 0' - 5' cover -

@ $________________ L.F. Total $_______________

b. 4,975 L.F. 16" prestressed concrete pipeline, 0' - 5' cover -

@ $________________ L.F. Total $_______________

NOTE: The Owner at his option may deduct any or all 16 inch pipelines at the unit price bid.

Item 4 - Ductile Iron Push-on Joint Pipelines: For furnishing and installing ductile iron pipelines as shown on the drawings and specified.

a. 18 L.F. 14" pipeline, 0' - 5' cover -

@ $____________ L.F. Total $____________

b. 54 L.F. 12" pipeline, 0' - 5' cover -

@ $____________ L.F. Total $____________

Item 5 - Gray or Ductile Cast Iron Push-on Joint Pipelines: For furnishing and installing cast iron pipelines as shown on the drawings and specified.

a. 54 L.F. 8" cast iron pipelines, 0' - 5' cover -

@ $____________ L.F. Total $____________

b. 296 L.F. 6" cast iron pipeline, 0' - 5' cover -

@ $____________ L.F. Total $____________

Item 6 - Extra Depth of Cover: For additional trenching and backfilling to clear underground utilities and obstructions, in addition to price bid for nominal depth, as specified.

a. 700 L.F. 36" pipe, 5' - 7' cover -

@ $____________ L.F. Total $____________

b. 500 L.F. 36" pipe, 7' - 9' cover -

@ $____________ L.F. Total $____________

c. 700 L.F. 20" pipe, 5' - 7' cover -

@ $____________ L.F. Total $____________

d. 100 L.F. 20" pipe, 7' - 9' cover -

@ $____________ L.F. Total $____________

e. 500 L.F. 16" pipe, 5' - 7' cover -

@ $____________ L.F. Total $____________

f. 100 L.F. 16" pipe, 7' - 9' cover -

@ $____________ L.F. Total $____________

g. 50 L.F. 16" pipe, 9' - 11' cover -

@ $____________ L.F. Total $____________

h. 50 L.F. 16" pipe, 11' - 13' cover -

@ $____________ L.F. Total $____________

Item 7 - Ductile Iron Mechanical Joint or Prestressed Concrete Fittings: For furnishing and installing ductile iron, mechanical joint or prestressed concrete fittings as shown on the drawings and specified.

a. 40.0 Tons of 36", 24", 20", and 16" ductile iron fittings -

@ $______________ Per Ton Total $______________

b. Prestressed concrete fittings, lump sum -

@ $______________ Lump Sum Total $______________

Item 8 - Ductile Iron Mechanical Joint Fittings - For furnishing and installing ductile iron, mechanical joint fittings as shown on the drawings and specified.

a. 2 Tons of 12", 8" and 6" fittings -

@ $______________ Per Ton Total $______________

Item 9 - Butterfly and Gate Valves: For furnishing and installing mechanical joint gate valves and valve boxes as shown on the drawings and specified.

a. 3 EA. 36" butterfly valves with valve boxes -

@ $______________ EA. Total $______________

b. 10 EA. 20" gate valves with valve boxes -

@ $______________ EA. Total $______________

c. 11 EA. 16" gate valves with valve boxes -

@ $______________ EA. Total $______________

d. 1 EA. 14" gate valves with valve boxes -

@ $______________ EA. Total $______________

e. 2 EA. 12" gate valves with valve boxes -

@ $______________ EA. Total $______________

f. 2 EA. 8" gate valves with valve boxes -

@ $______________ EA. Total $______________

g. 27 EA. 6" gate valves with valve boxes -

@ $________________EA. Total $________________

Item 10 - Fire Hydrants and Blowoffs: For furnishing and installing fire hydrants and blowoffs as shown on the plans and specified.

a. 6 Each, Fire Hydrant, Type "A" connection -

@ $________________EA. Total $________________

b. 2 Each, Fire Hydrant, Type "B" connection -

@ $________________EA. Total $________________

c. 11 Each, Blowoff, Type "C" Connection, including Fire Hydrant -

@ $________________EA. Total $________________

d. 2 Each, Blowoff, Type "E" Connection, including Headwall -

@ $________________EA. Total $________________

Item 11 - Connections to Existing Lines: For furnishing and installing connections to existing lines, except for valves and fittings under other items, as shown on the drawings and specified.

a. 1 EA. to Existing 36" Line -

@ $________________EA. Total $________________

b. 1 EA. to Existing 20" Line -

@ $________________EA. Total $________________

c. 2 EA. to Existing 6" Line -

@ $________________EA. Total $________________

Item 12 - Concrete Blocking and Strapping Sets: For furnishing and installing Class "B" concrete blocking and strapping sets as shown on the drawings and specified.

a. 190 Cu.Yd. Class "B" concrete blocking -

@ $________________CU.YD. Total $________________

b. 29 Each Strapping Sets -

@ $________________EA. Total $________________

Item 13 - Removing and Replacing Pavement: For removing and replacing pavement as shown on the drawings and specified.

a. 27,200 L.F. of plant mix paving in streets -

@ $____________ L.F. Total $____________

b. 475 L.F. concrete curb and gutter -

@ $____________ L.F. Total $____________

Item 14 - Air Valves and Manholes and Air Relief Connection:

a. 3 EA. 2" air valve and manhole -

@ $____________ EA. Total $____________

b. 3 EA. 2" air valve and manhole with 20" entry -

@ $____________ EA. Total $____________

c. 1 EA. 1" air relief connection -

@ $____________ EA. Total $____________

Item 15 - Highway and Railroad Crossings: For furnishing and installing tunnel liner by the tunneling method as shown on the drawings and specified.

a. 60 L.F. Highway Crossing
48" Tunnel Liner for 20" Pipe -
Line "A" Sta. 134+17 to 134+77

@ $____________ L.F. Total $____________

b. 72 L.F. Highway Crossing
72" Tunnel Liner for 36" Pipe
Line "B" Sta. 56+63 to 57+35

@ $____________ L.F. Total $____________

c. 60 L.F. Highway Crossing
72" Tunnel Liner for 36" Pipe
Line "B" Sta. 81+72 to 82+32

@ $____________ L.F. Total $____________

d. 132 L.F. Railroad Crossing
72" Tunnel Liner for 36" Pipe
Line "B" Sta. 29+95 to 31+27

@ $____________ L.F. Total $____________

NOTE: The Owner at his option may deduct Item 15 b. and/or Item 15 c.

e. 60 L.F. Railroad Crossing
48" Tunnel Liner for 16" Pipe
Line "C" Sta. 13+43 to 14+03

@ $____________ L.F. Total $____________

f. 60 L.F. Railroad Crossing
48" Tunnel Liner for 16" Pipe
Line "D" Sta. 14+08 to 14+68

@ $____________ L.F. Total $____________

Item 16 - Rock Excavation: For furnishing equipment and material and performing labor necessary for rock excavation in trenches as specified.

a. 3,000 CU.YD. rock excavation -

@ $ 15.00 C.Y. Total $ 45,000.00

Item 17 - Extra Work, if Ordered by Engineer:

a. 25 U.L.F. Fire Hydrant Extensions -

@ $____________ Each Total $____________

b. 400 CU.YD. Crushed Stone Stabilization -

@ $____________ C.Y. Total $____________

c. 10 CU.YD. Class "C" Concrete -

@ $____________ C.Y. Total $____________

TOTAL DIVISION ONE - Items 1 thru 17, inclusive, using Lowest Cost Materials,

the amount of ____

________________________________ Dollars ($________________)

DIVISION TWO

ADDITIONS TO WATER TREATMENT PLANT

SECTION I: CONSTRUCTION: For furnishing all materials (except Major Mechanical and Electrical Equipment listed in Section II and other work listed in Section III) and equipment and performing all labor necessary for constructing additions to Water Treatment Plant complete, including clearing, excavating, backfill, grading, structural, piping, superstructures, electrical, painting and all other work and appurtenances necessary for completion of the work under this contract as shown on the Drawings and/or specified;

a. Total Construction using Alternate "A" Filter System, the amount of ______________________________

______________________________ Dollars ($__________)

b. Total Construction using Alternate "B" Filter System, the amount of ______________________________

______________________________ Dollars ($__________)

SECTION II: MAJOR MECHANICAL, INSTRUMENTATION, CONTROL, AND ELECTRICAL EQUIPMENT: For furnishing and installing the following major items of equipment: (The Bidder may submit prices on various approved makes of equipment as specified under detail specifications.) Prices on certain makes of equipment are required as indicated; use lowest price for base bid.

EQUIPMENT

Item No.	Description	Price	Base Bid
2	Flocculation Equipment		
	Make Rex-Chainbelt	$__________	
	Make ______________________	$__________	$__________
3	Sludge Collectors		
	Make Rex-Chainbelt	$__________	
	Make ______________________	$__________	$__________

Item No.	Description	Price	Base Bid
4	Controllers		
	Make BIF	$	
	Make	$	$
5	Chemical Feed Equipment		
	Make Wallace & Tiernan	$	
	Make	$	$
6	Chlorination Equipment		
	Make Wallace & Tiernan	$	
	Make	$	$
7	Instrumentation Equipment		
	Make BIF	$	
	Make	$	$
8	Post Mixing Equipment		
	Make Rex-Chainbelt	$	
	Make	$	$
9	Butterfly Valves		
	Make Pratt	$	
	Make	$	$

Sub-Total, SECTION II, Items 2 thru 9, Inclusive $

ALTERNATE EQUIPMENT

The Bidder at his own option, may offer in the spaces provided below the price and name of other makes of equipment which he may desire to substitute for specified makes of equipment listed in the Proposal in Section II above.

Make of Alternate Equipment	Price
Make ______________________________	$__________
Description ______________________________	
Make ______________________________	$__________
Description ______________________________	
Make ______________________________	$__________
Description ______________________________	
Make ______________________________	$__________
Description ______________________________	
Make ______________________________	$__________
Description ______________________________	
Make ______________________________	$__________
Description ______________________________	
Make ______________________________	$__________
Description ______________________________	
Make ______________________________	$__________
Description ______________________________	
Make ______________________________	$__________
Description ______________________________	

SECTION III: EXTRA WORK, IF ORDERED BY ENGINEER (To cover authorized changes in scope of lump sum work in SECTIONS I and II).

Unit Prices used in this Section of the Proposal shall reflect current Unit Prices including allowances for overhead and profit. Failure to do so shall be considered as an unbalanced Bid and subject to rejection by the Owner.

Item No.	Approx. Quantity	Unit	Description	Unit Price	Amount
10			Excavation and Backfill		
(a)	150	Cu.Yd.	Structure, Earth	$	$
(b)	150	Cu.Yd.	Trench, Earth	$	$
(c)	100	Cu.Yd.	Rock Excavation	$ 15.00	$ 1,500.00
(d)	150	Cu.Yd.	Crushed Stone Backfill	$	$
(e)	200	Sq.Ft.	Steel Sheeting, Left in Place	$	$
11			Concrete Work		
(a)	20	Cu.Yd.	Class "A" Concrete	$	$
(b)	20	Cu.Yd.	Class "B" Concrete	$	$
(c)	30	Cu.Yd.	Class "C" Concrete	$	$
(d)	3	Tons	Reinforcing Steel	$	$
(e)	1,000	Sq.Ft.	Contact Forms	$	$
12			C.I. Pipe, in Place (M.J. or Flange)		
(a)	40	Lin.Ft.	2-Inch	$	$
(b)	30	Lin.Ft.	4-Inch	$	$
(c)	30	Lin.Ft.	6-Inch	$	$
(d)	20	Lin.Ft.	8-Inch	$	$
(e)	20	Lin.Ft.	10-Inch	$	$
(f)	20	Lin.Ft.	12-Inch	$	$
(g)	20	Lin.Ft.	16-Inch	$	$
(h)	20	Lin.Ft.	24-Inch	$	$

Item No.	Approx. Quantity	Unit	Description	Unit Price	Amount
(i)	20	Lin.Ft.	30-Inch	$	$
(j)	20	Lin.Ft.	36-Inch	$	$
13			C.I. Fittings		
(a)	1.0	Tons	Mechanical Joint	$	$
(b)	1.0	Tons	Flanged	$	$
14			Plug Valves (Flanged) (Use Type in Base Bid) (St'd Setting)		
(a)	2	Each	4-Inch	$	$
(b)	2	Each	6-Inch	$	$
(c)	2	Each	8-Inch	$	$

Sub-Total, SECTION III, Items 10 thru 14, Inclusive $__________

TOTAL, DIVISION TWO, Sum Total, SECTIONS I, II and III, using Lowest Cost Filter System, the amount of

____

______________________________ Dollars ($________________)

GRAND TOTAL DIVISION ONE and TWO, the amount of

____

______________________________ Dollars ($________________)

Deduct if Awarded DIVISION ONE and TWO $________________

DEDUCTIONS

The Owner reserves the right to make certain changes in the work for the purpose of making an award. Each bidder shall fill in the deductible amounts as required below. Any or all deductions may be made at the option of the Owner.

D-1 Deduct from the contract (total Division Two) the superstructures on the existing and proposed filters, including masonry, structural steel, quarry tile, heating, ventilating, and fluorescent lighting as shown on the drawings and specified, and substitute Alternate "C" superstructures as indicated on the drawings and specified.

Deduct $______________

D-2 The Owner will retain the option to substitute rye grassing for bermuda grassing until the completion of construction.

Deduct $______________

D-3 The Owner will retain the option to eliminate all grassing until the completion of construction.

Deduct $______________

D-4 The Owner will retain the right to eliminate paving until the completion of construction.

Deduct $______________

The Bidder acknowledges receipt of Addendum(a) No.(s)_________________.

The Bidder declares that he understands that the quantities shown in the Proposal are subject to adjustment by either increase or decrease, and that should the quantities of any of the items of work be increased, the undersigned proposes to do the additional work at the unit prices stated herein; and should the quantities be decreased, he also understands that payment will be made on actual quantities at the unit price bid and will make no claim for anticipated profits for any decrease in the quantities and that actual quantities will be determined upon completion of work, at which time adjustment will be made to the Contract amount by direct increase or decrease. The Bidder further proposes and agrees hereby to commence work under this contract on a date to be specified in a written order of the Engineer, and shall fully complete all work under this contract within the hereinafter stated number of consecutive calendar days from and including said date, the completion time for more than one division of work shall run concurrently.

Division One	370 Days
Division Two	640 Days

The undersigned further agrees that, in case of failure on his part to execute the said Contract and the Bond within ten (10) consecutive calendar days after written notice being given of the award of the Contract, the Check or Bid Bond accompanying this Bid, and the monies payable thereon, shall be paid into the funds of the City of Athens, Georgia, as liquidated damages for such failure; otherwise, the Check or Bid Bond accompanying this Proposal shall be returned to the undersigned.

Attached hereto is a Certified Check on the __________________________

_______________________ Bank of ____,

or a Bid Bond by the ____,

in the amount of ____

____Dollars ($___________________)

made payable to the City of Athens, Georgia, in accordance with the conditions of the Advertisement and provisions herein.

Bidder:____

By:____

Title:____

(Note: If the Bidder is a Corporation, the Proposal shall be signed by an officer of the Corporation; if a partnership, it shall be signed by a partner, if signed by others, authority for signature shall be attached.)

Bidder's Address:____

Bidder's Phone No.:____

The full names and residences of persons and firms interested in the foregoing Bid, as principals, are as follows:

____

____

____

____

____

EXPERIENCE AND REFERENCES

The Bidder shall here state what work he has done of similar nature of that bid for, and give references that will afford the Owner opportunity to judge as to experience, skill, business standing and financial ability.

Budget Bureau No. 63R1137

U. S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

CERTIFICATION OF BIDDER REGARDING EQUAL EMPLOYMENT OPPORTUNITY

INSTRUCTIONS

This certification is required pursuant to Executive Order 11246 (30 F. R. 12319-25). The implementing rules and regulations provide that any bidder or prospective contractor, or any of their proposed subcontractors, shall state as an initial part of the bid or negotiations of the contract whether it has participated in any previous contract or subcontract subject to the equal opportunity clause; and, if so, whether it has filed all compliance reports due under applicable instructions.

Where the certification indicates that the bidder has not filed a compliance report due under applicable instructions, such bidder shall be required to submit a compliance report within seven calendar days after bid opening. No contract shall be awarded unless such report is submitted.

CERTIFICATION BY BIDDER

Bidder's Name: ______________________________

Address and Zip Code: ______________________________

____

1. Bidder has participated in a previous contract or subcontract subject to the Equal Opportunity Clause.
   Yes ☐ No ☐ *(If answer is yes, identify the most recent contract.)*

2. Compliance reports were required to be filed in connection with such contract or subcontract.
   Yes ☐ No ☐ *(If answer is yes, identify the most recent contract.)*

3. Bidder has filed all compliance reports due under applicable instructions, including SF-100.
   Yes ☐ No ☐ None Required ☐

4. If answer to item 3 is "No," please explain in detail on reverse side of this certification.

Certification – The information above is true and complete to the best of my knowledge and belief.

____
Name and Title of Signer (Please Type)

____
Signature

____
Date

HUD-4238-CD-1 (3-70) Previous Edition is Obsolete

GPO 892-820

FORM APPROVED
BUDGET BUREAU NO. 63.R1138

HUD-4238-CD-2
(2-67)

U. S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

CERTIFICATION BY PROPOSED SUBCONTRACTOR REGARDING EQUAL EMPLOYMENT OPPORTUNITY

NAME OF PRIME CONTRACTOR ______________________ PROJECT NO. ________

INSTRUCTIONS

This certification is required pursuant to Executive Order 11246 (30 F.R. 12319-25). The implementing rules and regulations provide that any bidder or prospective contractor, or any of their proposed subcontractors, shall state as an initial part of the bid or negotiations of the contract whether it has participated in any previous contract or subcontract subject to the equal opportunity clause; and, if so, whether it has filed all compliance reports due under applicable instructions.

Where the certification indicates that the subcontractor has not filed a compliance report due under applicable instructions, such subcontractor shall be required to submit a compliance report before the owner approves the subcontract or permits work to begin under the subcontract.

SUBCONTRACTOR'S CERTIFICATION

Subcontractor's Name: ______________________

Address: ______________________

____

1. Bidder has participated in a previous contract or subcontract subject to the Equal Opportunity Clause.
   Yes ☐ No ☐
2. Compliance reports were required to be filed in connection with such contract or subcontract.
   Yes ☐ No ☐
3. Bidder has filed all compliance reports due under applicable instructions, including SF-100.
   Yes ☐ No ☐ None Required ☐
4. If answer to item 3 is "No," please explain in detail on reverse side of this certification.

Certification – The information above is true and complete to the best of my knowledge and belief.

____
NAME AND TITLE OF SIGNER *(Please Type)*

______________________ ______________________
SIGNATURE DATE

GP O 9 28-8 12

CERTIFICATION BY CONTRACTOR

regarding

NONSEGREGATED FACILITIES

The Contractor certifies that he does not, and will not, provide and maintain segregated facilities for his employees at his establishments and, further, that he does not, and will not, permit his employees to perform their services at these locations under his control, where segregated facilities are provided and maintained. Segregated facilities include, but are not necessarily limited to, drinking fountains, transportation, parking, entertainment, recreation, and housing facilities, waiting, rest, wash, dressing, and locker rooms; and time clock, work, storage, restaurants, and other eating areas which are set apart in-fact, or by explicit directive, habit, local custom, or otherwise, on the basis of color, creed, national origin, and race. The Contractor agrees that, except where he has obtained identical certifications from proposed subcontractors for specific time periods, he will obtain identical certifications from those proposed subcontractors who are not exempt from the provisions of the Equal Opportunity clause prior to the award of subcontracts exceeding $10,000, and that he will retain such certifications in his files.

The Contractor agrees that a breach of this certification is a violation of the Equal Opportunity clause in this Contract; the penalty for making false statements is prescribed in 18 U.S.C. 1001.

(Name of Contractor)

(Signature) (Date)

(Name and Title of Signer - Please Print)

PS-CNF-1

CERTIFICATION BY PROPOSED SUBCONTRACTOR

regarding

NONSEGREGATED FACILITIES

____
(Name of Contractor)

Proposed Subcontractor's Name ____
(Please Print)

Address and Zip Code ____
(Please Print)

____
(Please Print)

The Proposed Subcontractor certifies that he does not and will not, provide and maintain segregated facilities for his employees at his establishments and, further, that he does not, and will not, permit his employees to perform their services at these locations under his control, where segregated facilities are provided and maintained. Segregated facilities include, but are not necessarily limited to, drinking fountains, transportation, parking, entertainment, recreation, and housing facilities; waiting, rest, wash, dressing, and locker rooms; and time clock, work, storage, restaurants, and other eating areas which are set apart in-fact, or by explicit directive, habit, local custom, or otherwise, on the basis of color, creed, national origin, and race. The Proposed Subcontractor agrees that, except where he has obtained identical certifications from his suppliers for specific time periods, he will obtain identical certifications from those suppliers who are not exempt from the provisions of the Equal Opportunity clause prior to the award of contracts exceeding $10,000, and that he will retain such certifications in his files.

The Proposed Subcontractor agrees that a breach of this certification is a violation of the Equal Opportunity clause in this Contract; the panelty for making false statements is prescribed in 18 U.S.C. 1001.

______________________________ _______________
(Signature) (Date)

____
(Name and Title of Signer - Please Print)

HUD-4238-J
(2-66)

U.S. Department of Housing and Urban Development

CERTIFICATE OF OWNER'S ATTORNEY

I, the undersigned, ____, the duly authorized and acting legal representative of __________________________ ____, do hereby certify as follows:

I have examined the attached contract(s) and surety bonds and the manner of execution thereof, and I am of the opinion that each of the aforesaid agreements has been duly executed by the proper parties thereto acting through their duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of the respective parties named thereon; and that the foregoing agreements constitute valid and legally binding obligations upon the parties executing the same in accordance with terms, conditions and provisions thereof.

____

Date: ________________________

219934-P HUD-Wash., D. C. ☆ G. P. O. 1973 — 746-178 / 933

CONSTRUCTION AGREEMENT

THIS CONSTRUCTION AGREEMENT is made and entered into on the ________ day of ____________________, by and between ________________________________ ________________________, party of the first part (hereinafter called the "Contractor" and the City of Athens, Georgia (hereinafter called the "Owner"), the party of the second part.

WITNESSETH:

That the Contractor, for the consideration hereinafter fully set out hereby agrees with the Owner as follows:

1. That the Contractor will furnish all equipment, tools, materials, skill, and labor of every description, necessary to carry out, and to complete in a good, firm, substantial and workmanlike manner, the work specified, in strict conformance with the Drawings entitled: City of Athens, Georgia, Water Works Improvements, Division _____, August, 1976.

on file in the office of the Owner and the Construction Specifications hereinafter set forth, which Drawings and Construction Specifications, together with the foregoing Bid, Advertisement for Bids, Instructions to Bidders and Special Provisions, General Conditions, Performance and Payment Bonds, and all Addenda hereto annexed, shall form essential parts of this Construction Agreement, as if fully contained herein. The work covered by this Construction Agreement includes all work as shown on the Drawings, specified, and listed in the attached Bid, under the following items, to wit:

____

____

2. That the Contractor shall commence the work to be performed under this Construction Agreement on a date to be specified in a written order from the Engineer and shall fully complete all work hereunder within _____ consecutive calendar days from that date, except as otherwise provided in these documents for extension of the above time limit. Time is of the essence of this Construction Agreement, and the Contractor shall pay to the Owner, not as a penalty, but as liquidated damages, the sum of one hundred dollars ($100.00) for each calendar day that he shall be in default of completing the work within the time limit named herein. Because of the difficulty of fixing damages suffered by the Owner on account of such default, damages are herein agreed upon as stated.

3. The Owner hereby agrees to pay to the Contractor for the faithful performance of this Construction Agreement, subject to additions and deductions as provided in the Construction Specifications or Bid, in lawful money of the

United States, the sum of ____

____Dollars ($____________)

4. Payments on Account: Not later than the 15th day of each calendar month, as the work progresses, the Owner shall make partial payment to the Contractor up to 90% of the value of labor and materials incorporated in the work and of materials on hand at the site of the work for and including the last day of the preceding month, less payments already made and less deductions for any unaccepted or defective work. The Owner may also withhold from time to time payment to the Contractor in such an amount or amounts as may be necessary to pay and fully satisfy all claims and demands for labor and services rendered and materials furnished in and about the work as elsewhere provided for in these documents.

5. Final Payment: Upon written notice given to the Owner by the Contractor of the final completion of the work, the Engineer will make an inspection of the work and conduct a test, and if acceptable under the Contract, shall issue a final certificate that the balance is due the Contractor. Upon completion of the thirty (30) day operating period the Owner shall make final payment to the Contractor of the balance due under the Contract, less such amounts as may have been withheld and employed by the Owner from time to time, as provided in the preceding paragraph, to pay all claims and demands for labor, service, and final payment the Contractor shall submit satisfactory evidence under oath that all payrolls and all amounts due for labor and materials and other indebtedness connected with the work have been fully paid and satisfied and that there are no outstanding claims or demands against the Contractor connected with the work.

6. It is further mutually agreed between the parties hereto that, if at any time after the execution of this Construction Agreement and the surety bond hereto attached for its faithful performance, the Owner shall deem the surety or sureties upon such bond to be unsatisfactory or, if for any reason, such bond ceases to be adequate to cover the performance of the work, the Contractor shall, at his expense, within five (5) days after the receipt of notice from the Owner so to do, furnish an additional bond or bonds in such form and amount, and with such surety or sureties as shall be satisfactory to the Owner. In such event no further payment to the Contractor shall be deemed to be due under this Construction Agreement until such new or additional security for the faithful performance of the work shall be furnished in manner and form satisfactory to the Owner.

IN WITNESS WHEREOF, the parties hereto have executed this Construction Agreement under their respective seals on the day and date first above written in six (6) counterparts, each of which shall without proof or accounting for the other counterparts be deemed an original agreement.

ATTEST: (As to Contractor)	* CONTRACTOR
Signed and sealed in the presence of:	______________________________
1.______________________	By:________________________L.S.
2.______________________	
	Title:______________________
(SEAL)	ATTEST: (SEAL)
	By:________________________ Secretary
ATTEST:	CITY OF ATHENS, GEORGIA
By:______________________ City Clerk	By:________________________ Mayor
	APPROVED AS TO FORM BEFORE EXECUTION
	By:________________________L.S. Attorney for the City of Athens, Georgia

*(NOTE: If the Contractor is a Corporation, the Construction Agreement shall be signed by the President or Vice-President, attested by the Secretary, and the corporate seal affixed. If the Contractor is a Partnership, the Construction Agreement shall be signed in the Partnership name by one of the partners, with indication that he is a general partner.)

PERFORMANCE BOND

CLARKE COUNTY)
) ss:
STATE OF GEORGIA)

KNOW ALL MEN BY THESE PRESENTS, that we, ______________________________

____________________________________, hereinafter known as the "Contractor",

as principal, and ____,

as surety, are held and firmly bound unto the City of Athens, Georgia, hereinafter known as the "Owner", in the penal sum of ______________________________

____

____Dollars ($________________)

lawful money of the United States of America, to be paid to the Owner, for the use and benefit of the said obligee, and of all persons doing work or furnishing skill, tools, machinery or materials under or for the purpose of the contract hereinafter named, for which payment, well and truly to be made, we bind ourselves, our successors and our several respective heirs, assigns, executors and administrators, jointly and severally, firmly by these presents.

SEALED WITH OUR SEALS AND DATED THIS THE ______ DAY OF ________________, 1976.

WHEREAS, the above bounden ________________________________ by an instrument in writing, bearing even date, with these presents, has contracted with the Owner to furnish all equipment, tools, materials, skill and labor for the completion of the work covered by the following items of the attached Proposal for constructing Water System Improvements, to wit:

____

____

____

All work to be performed in strict accordance with the attached Agreement or Contract and Specifications, which Contract is by reference made a part hereof:

NOW, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said

____

shall complete the work provided for in said Contract according to the terms, and shall save the obligee hereunder free from all costs and charges that may accrue on account of the doing of the work specified in the Contract, and shall comply with the laws appertaining to said Contract, then this obligation shall be null and void; otherwise, it shall remain in full force and effect.

AND THE FURTHER CONDITION OF THIS OBLIGATION IS SUCH THAT IF

____, as Contractor, shall fully and faithfully perform the work in accordance with the terms of the annexed Contract therefor and the Plans and Specifications therein referred to, and provide the materials therein called for, and replace defective work or material for a period of one year after the completion of this contract, then

this obligation shall be null and void; otherwise, they, ________________

____, as Contractor,

and ____, as Surety,

jointly and severally agree to pay the Owner the difference between the sum to

which the said ____,

as Contractor, would be entitled in the completion of the Contract, and that which the Owner may be obliged to pay for the completion of the work by Contract, or otherwise, and agree to pay any damage, direct or indirect or consequential, which said Owner may sustain on account of such work or on account of the failure of said Contractor, properly and in all things to keep and execute the provisions of the Contract.

And the said ____, as

Contractor, and ____,

as Surety, hereby further bind themselves, their successors, assigns, heirs, executors and administrators, jointly and severally, that they will indemnify and save harmless and will pay all amounts, damages, costs and judgments which may be recovered against, and all expenses incurred by, the Owner and all representatives of said Owner from or arising out of all or any suits, actions, or claims of any character brought on account of any injuries or damages sustained by any persons or property in consequence of any neglect in safeguarding the work, or any such suit or claim arising from any other act, omission, negligence or misconduct of the Contractor, his agents, representatives, servants and employees in the performance of said work or of the repair or maintenance thereof, or the manner of doing the same, or the neglect of said Contractor, or agents or servants, or the improper performance of the said work by the Contractor or agents or servants, or the infringement of any patent rights by reason of the use of any equipment or materials furnished under the said Contract, and will also pay any damages for delay in performance within the time agreed, as stated in the Contract; further, failure so to do with such persons, firms, partnerships or corporation shall give them a direct right of action against the principal and surety under this obligation.

As the said surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration, or addition to the terms of the Contract or to the work to be performed thereunder, or the Specifications accompanying the same, shall in any wise affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract, or to the work, or to the Specifications.

Without limiting the effect of any other provisions herein contained, this Bond is to be construed as a statutory bond under the provisions of

Section 23-1705 of the 1933 Code of Georgia as amended to date.

IN WITNESS WHEREOF, the said ______________________________ has caused _____ corporate seal to be hereto affixed, and these presents to be signed in its name by ______________________________, and the said ______________________________, as surety, has caused _____ corporate seal to be hereto affixed and these presents to be signed in its name by ______________________________.

(As to Contractor)	* CONTRACTOR (SEAL)
Signed, sealed and delivered in the presence of:	______________________________
______________________________	By: ______________________________ L.S.
______________________________	Title: ______________________________
	ATTEST:
	______________________________ Secretary
(As to Surety)	
Signed, sealed and delivered in the presence of:	SURETY (SEAL)
______________________________	______________________________
______________________________	By: ______________________________ Attorney in Fact
APPROVED AS TO FORM:	COUNTERSIGNED:
By: ______________________________ Att Attorney for the City of Athens, Georgia	By: ______________________________ Resident Agent (Resident of Clarke County)

*(NOTE: If the Principal is a corporation, the bond shall be signed by the President or a Vice-President, attested by the Secretary and the corporate seal affixed. If the Principal is a partnership, the bond shall be signed in the partnership name by one of the partners, with indication that he is a general partner.)

PAYMENT BOND

CLARKE COUNTY)
) ss:
STATE OF GEORGIA)

KNOW ALL MEN BY THESE PRESENTS, that we, ______________________________

____________________________________, hereinafter known as the "Contractor",

as principal, and ____,

as surety, are held and firmly bound unto the City of Athens, Georgia, hereinafter known as the "Owner", in the penal sum of ____________________________

____

____Dollars ($______________)

lawful money of the United States of America, to be paid to the Owner, for the use and benefit of the said obligee, and of all persons doing work or furnishing skill, tools, machinery or materials under or for the purpose of the Contract hereinafter named, for which payment, well and truly to be made, we bind ourselves, our successors and our several respective heirs, assigns, executors and administrators, jointly and severally, firmly by these presents.

SEALED WITH OUR SEALS AND DATED THIS ________ DAY OF ________________, 1976.

WHEREAS, the above bounden ____

by an instrument in writing, bearing even date, with these presents, has contracted with the Owner to furnish all equipment, tools, materials, skill and labor for the completion of the work covered by the following items of the attached Proposal for constructing Water System Improvements, to wit:

____

____

____

All work to be performed in strict accordance with the attached Agreement or Contract and Specifications, which Contract is by reference made a part hereof:

NOW, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said

____

and all subcontractors to whom any portion of the work provided for in the attached Agreement or Contract is sublet and all assignees of the said

____,

and of such subcontractors shall promptly make payments to all persons supplying him or them with labor, materials, or supplies for or in the prosecution of the work provided for in such Contract, or in any amendment or extension of or addition to said Contract, and for the payment of reasonable attorney's fees, incurred by the claimant or claimants in suits on said bond, then the above obligation shall be void; otherwise, to remain in full force and effect.

PROVIDED, however, that this bond is subject to the following conditions and limitations:

(a) Any person, firm or corporation that has furnished labor, materials, or supplies for or in the prosecution of the work provided for in said Contract shall have a direct right of action against the Contractor and Surety on this bond, which right of action shall be asserted in a proceeding, instituted in the county in which the work provided for in said Contract is to be performed or in any county in which said Contractor or Surety does business. Such right of action shall be asserted in a proceeding instituted in the name of the claimant or claimants for his or their use and benefit against said Contractor and Surety or either of them (but not later than one year after the final settlement of said Contract) in which action such claim or claims shall be adjudicated and judgment rendered thereon.

(b) The Principal and Surety hereby designate and appoint the

____CITY CLERK OF ATHENS, GEORGIA________, as the agent of each of them

to receive and accept service of process or other pleading issued or filed in any proceeding instituted on this bond and hereby consent that such service shall be the same as personal service on the Contractor and/or Surety.

(c) In no event shall the Surety be liable for a greater sum than the penalty of this bond, or subject to any suit, action or proceeding thereon that is instituted later than one year after the final settlement of said Contract.

(d) This bond is given pursuant to the terms of Section 23-1705 of the 1933 Code of Georgia as amended as all the provisions of law with reference to this character of bond as set forth in said section or as may hereinafter be enacted are hereby made a part hereof to the same extent as if set out herein in full.

IN WITNESS WHEREOF, the said ____

has caused _____ corporate seal to be hereto affixed, and these presents to be

signed in its name by ____,

and the said ____,

as surety, has caused _____ corporate seal to be hereto affixed and these

presents to be signed in its name by ______________________________.

(As to Contractor)

Signed, sealed and delivered
in the presence of:

____

____

* CONTRACTOR (SEAL)

____

By: ______________________________ L.S.

Title: ______________________________

ATTEST:

____
Secretary

(As to Surety)

Signed, sealed and delivered
in the presence of:

____

____

SURETY (SEAL)

____

By: ______________________________
Attorney in Fact

APPROVED AS TO FORM:

By: ______________________________
Attorney for the
City of Athens, Georgia

COUNTERSIGNED:

By: ______________________________
Resident Agent
(Resident of Clarke County)

*(NOTE: If the Principal is a Corporation, the bond shall be signed by the President or a Vice-President, attested by the Secretary and the Corporate seal affixed. If the Principal is a Partnership, the bond shall be signed in the Partnership name by one of the partners, with indication that he is a general partner.)

GENERAL CONDITIONS

1. Contract Security: The Contractor shall furnish two surety bonds (forms attached) each in an amount at least equal to one hundred (100%) per cent of the Contract price, one as security for the faithful performance of this Contract and to indemnify the Owner against liability for personal injury and property damage, and one for the payment of all persons performing labor and furnishing materials in connection with this Contract. The surety on each bond shall be a surety company satisfactory to the Owner, duly authorized to do business in Georgia. The bond shall be countersigned by an agent who is a resident of the County. The person executing the bond on behalf of the surety shall file with the bond a general power of attorney unlimited as to amount and type of bond covered by such power of attorney, and certified to by an official of said surety.

2. Contractors' and Subcontractors' Insurance: The Contractor shall not commence work under this Contract until he has obtained all the insurance required under this paragraph and such insurance has been approved by the Owner, nor shall the Contractor allow any subcontractor to commence work on his subcontract until all similar insurance required of the subcontractor has been so obtained and approved.

(a) Compensation Insurance: The Contractor shall procure and shall maintain during the life of this Contract Workmen's Compensation Insurance for all of the employees to be engaged in work on the project under this Contract, and in any case any such work is sublet, the Contractor shall require the subcontractor similarly to provide Workmen's Compensation Insurance for all of the latter's employees to be engaged in such work unless such employees are covered by the Protection afforded by the Contractor's Workmen's Compensation Insurance. In case any class of employees engaged in hazardous work on the project under this Contract is not protected under the Workmen's Compensation statute, the Contractor shall provide and shall cause such subcontractor to provide a Workmen's Compensation policy for the protection of such of his employees not otherwise protected.

(b) Public Liability Property Damage and Automobile Liability Insurance: The Contractor shall take out and maintain during the life of the Contract such Public Liability and Property Damage Insurance and Automobile Liability Insurance as shall protect him and any subcontractor performing work covered by this Contract from claims for damage for personal injury including accidental death as well as from claims for property damage, which may arise from operations under this Contract, whether such operations are by himself or by any subcontractor or by anyone directly or indirectly employed by either of them. The amount of such insurance shall be as follows:

(1) Public Liability Insurance in an amount not less than $150,000 for bodily injury, including accidental death, to any one person, and subject to the same limit for each person, in an amount not less than $300,000 on account of one accident.

(2) Property Damage Insurance in an amount not less than $150,000 for any one damage claim, and in an aggregate amount up to $300,000 during a period of twelve (12) months.

(3) Automobile Liability Insurance:

a. For bodily injury, including accidental death to any one person, in an amount not less than $150,000 and subject to the same limit for each person, in an amount not less than $300,000 on account of one accident;

b. For property damage in an amount not less than $150,000 for any one damage claim and in an aggregate amount up to $300,000 during a period of twelve (12) months.

(c) Owner's Protective Liability Insurance: Issued in the name of the Owner for liability and property damage in the same amounts as stipulated for the Contractor.

(d) Contractual Indemnity: In addition to the hereinabove described insurance required to be maintained and paid for by the Contractor, during the life of the Contract the Contractor also hereby specifically and distinctly agrees to indemnify, defend and hold harmless the Owner from all suits, actions, legal proceedings, claims, demands, damages, costs, expenses and attorney's fees (herein called "claims") and from all expense in defending claims, including without limitation court cost, attorney's fees, the amount of any judgments recovered, and any other expenses resulting from claims for bodily injury, sickness or disease, including death resulting therefrom, sustained by any person, and/or resulting from claims for injury to or destruction of property, including loss or use thereof, caused by, arising from, incident to, connected with, or growing out of the performance of this Contract, including without limitation, the act or omission of the Contractor, and his agents, servants or employees, and/or by any subcontractor, and his agents, servants or employees, and/or by the Owner, his agents, servants or employees.

(e) Fire Insurance: The Contractor shall insure all work against loss or damage by fire and against loss or damage covered by the standard extended coverage insurance indorsement, the amount of the insurance at all times to be at least equal to the amount paid on account of work and materials. The policies shall be in the names of the Owner and the Contractor as their interests may appear.

(f) Proof of Coverage of Insurance: The Contractor shall furnish the Owner with a certificate showing satisfactory proof of carriage of the insurance required prior to commencing work on his Contract.

(g) Scope of Insurance: The insurance required under subparagraphs (b) and (c) hereof shall provide adequate protection for the Contractor and his subcontractors, respectively, as well as the Owner, against damage claims which may arise from operations under this Contract, whether such operations be by the insured or by anyone directly or indirectly employed by him.

3. Accident Prevention: Precaution shall be exercised at all times for the protection of all persons, including employees, and property, and hazardous conditions shall be guarded against or eliminated. The Contractor shall be responsible for all injuries or damages to persons or property, and shall indemnify and save harmless the Owner, its officers and agents, from all damages and costs by reason of injury to person or property, resulting from negligence

or carelessness in the performance of the work or in guarding the same, or from any improper materials, implements, or appliances used in its construction, or on account of any act or omission of the Contractor, his agents or employees. The whole or as much of the monies due under and by virtue of this Contract as may be considered necessary by the Owner shall or may be retained by the Owner until all suits or claims for damages shall have been settled, and evidence to that effect furnished to the satisfaction of the Owner.

4. Laws: The construction of said project shall in all respects conform to all applicable requirements of federal, state, and local statutes, laws, and ordinances.

5. Safety Act: This project shall be safely accomplished, and in accord with the regulations prescribed by the Owner, in accord with the provisions of the "National Occupational Safety and Health Act of 1970 (P.L. 91-596)", and in accord with the United States Department of Labor's Safety and Health Regulations for Construction promulgated under the National Occupational Safety and Health Act of 1970 (P.L. 91-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (P.L. 91-54). Precautions shall be exercised to protect persons and property; hazardous conditions shall be guarded against or eliminated. The Contractor shall be responsible for all injuries and damages to persons and property, and shall indemnify and save harmless the Owner, its officers, employees, and agents, from all damages and costs by reason of injury to persons and property resulting from negligence and carelessness in the performance of the Project; in guarding the work, in the using of improper materials, implements, and appliances; and on account of acts and omissions by the Contractor, his agents, and employees. The whole, or as much, of the monies due under the CONSTRUCTION AGREEMENT, as may be considered necessary by the Owner until all suits and claims for damages shall have been settled, and satisfactory evidence to that effect furnished to the Owner.

6. Payments to Contractor:

(a) Not later than the 15th day of each calendar month the Owner will make a partial payment to the Contractor on the basis of a duly certified and approved estimate of the work performed during the preceding calendar month under this Contract, but to insure the proper performance of this Contract, the Owner will retain ten (10%) per cent of the amount of each estimate until final completion and acceptance of all work covered by this Contract.

(b) In preparing estimates the material delivered on the site and preparatory work done will be taken into consideration.

(c) All material and work covered by partial payments made shall thereupon become the sole property of the Owner, but this provision shall not be construed as relieving the Contractor from the sole responsibility for the care and protection of materials and work upon which payments have been made or the restoration of any damaged work, or as a waiver of the right of the Owner to require the fulfillment of all of the terms of the Contract.

(d) Owner's Right to Withhold Certain Amounts and Make Application Thereof: The Contractor agrees that he will indemnify and save the Owner harmless from all claims growing out of the lawful demands of subcontractors, laborers, workmen, mechanics, materialmen, and furnishers of machinery and

parts thereof, equipment, power tools, and all supplies, including commissary, incurred in the furtherance of the performance of this Contract. The Contractor shall furnish satisfactory evidence that all obligations of the nature hereinabove designated have been paid, discharged, or waived. If the Contractor fails to do so, then the Owner may, after having served written notice on the said Contractor, either pay unpaid bills, of which the Owner has written notice, direct, or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged, whereupon payment to the Contractor shall be resumed, in accordance with the terms of this Contract, but in no event shall the provisions of this sentence be construed to impose any obligations upon the Owner to either the Contractor or his surety. In paying any unpaid bills of the Contractor, the Owner shall be deemed the agent of the Contractor, and any payment so made by the Owner, shall be considered as a payment made under the Contract by the Owner to the Contractor and the Owner shall not be liable to the Contractor for any such payment made in good faith.

7. Payments by Contractor: The Contractor shall pay (a) for all transportation and utility services not later than the 20th day of the calendar month following that in which services are rendered, (b) for all materials, tools, and other expendable equipment to the extent of 90% of the cost thereof, not later than the 20th day of the calendar month following that in which such materials, tools and equipment are delivered at the site of the project, and the balance of the cost thereof not later than the 30th day following the completion of that part of the work in or on which such materials, tools and equipment are incorporated or used, and (c) to each of his subcontractors, not later than the 5th day following each payment to the Contractor, the respective amounts allowed the Contractor on account of the work performed by his subcontractors to the extent of each subcontractor's interest therein.

8. Subcontracting:

(a) The Contractor may utilize the services of specialty subcontractors on those parts of the work which, under normal contracting practices, are performed by specialty subcontractors.

(b) The Contractor shall not subcontract the complete work, or any major portion thereof, and shall not award any work to any subcontractor without prior written approval of the Owner, which approval will not be given until the Contractor submits to the Owner a written statement concerning the proposed award to the subcontractor, which statement shall contain such information as the Owner may require.

(c) The Contractor shall be as fully responsible to the Owner for the acts and omissions of his subcontractors, and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.

(d) The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the work to bind subcontractors to the Contractor by the terms of the General Conditions and other Contract Documents insofar as applicable to the work of subcontractors and to give the Contractor the same power as regards terminating any subcontract that

the Owner may exercise over the Contractor under any provision of the Contract Documents.

(e) Nothing contained in this Contract shall create any contractual relation between any subcontractor and the Owner.

9. Assignments: The Contractor shall not assign the whole or any part of this Contract or any monies due or to become due hereunder without written consent of the Owner. In case the Contractor assigns all or any part of any monies due or to become due under this Contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any monies due or to become due to the Contractor shall be subject to prior liens of all persons, firms and corporations for services rendered or materials supplied for the performance of the work called for in this Contract.

10. Time for Completion and Liquidated Damages: It is hereby understood and mutually agreed, by and between the Contractor and the Owner, that the date of beginning, rate of progress, and the time for completion of the work to be done hereunder are ESSENTIAL CONDITIONS of this Contract; and it is further mutually understood and agreed that the work embraced in this Contract shall be commenced on a date to be specified in the work order.

The Contractor agrees that said work shall be prosecuted regularly, diligently, and uninterruptedly at such rate of progress as will insure full completion thereof within the time specified. It is expressly understood and agreed, by and between the Contractor and the Owner, that the time for the completion of the work described herein is a reasonable time for the completion of the same, taking into consideration the average climatic range and usual industrial conditions prevailing in this locality.

IF THE SAID CONTRACTOR SHALL NEGLECT, FAIL OR REFUSE TO COMPLETE THE WORK WITHIN THE TIME HEREIN SPECIFIED, then the Contractor does hereby agree, as a part consideration for the awarding of this Contract, to pay to the Owner the amount specified in the Contract, not as a penalty, but as liquidated damages for such breach of Contract as hereinafter set forth, for each and every calendar day that the Contractor shall be in default after the time stipulated in the Contract for completing the work. The said amount is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain and said amount is agreed to be the amount of damages which the Owner would sustain and said amounts shall be retained from time to time by the Owner from current periodical estimates.

It is further agreed that time is of the essence of each and every portion of this Contract and of the Specifications wherein a definite and certain length of time is fixed for the performance of any act whatsoever; and where under the Contract an additional time is allowed for the completion of any work, the new time limit fixed by such extension shall be of the essence of this Contract, Provided, that the Contractor shall not be charged with liquidated damages or any excess cost when the delay in completion of the work is due.

(a) To any preference, priority, or allocation order duly issued by the Government;

(b) To unforeseeable cause beyond the control and without the fault or negligence of the Contractor, including, but not restricted to, acts of

God, or of the public enemy, acts of the Owner, acts of another contractor in the performance of a contract with the Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and unusually severe weather;

(c) To any delays of subcontractor occasioned by any of the causes specified in subsections (a) and (b) of this article:

Provided further, that the Contractor shall, within seven (7) days from the beginning of such delay, notify the Owner, in writing, of the causes of the delay, who shall ascertain the facts and extent of the delay and notify the Contractor within a reasonable time of its decision in the matter.

11. Construction Schedule and Periodic Estimates: Immediately after execution and delivery of the Contract, and before the first partial payment is made, the Contractor shall deliver to the Owner an Estimated Construction Progress Schedule in form satisfactory to the Owner, showing the prepared dates of commencement and completion of each of the various subdivisions of work required under the Contract Documents and the anticipated amount of each monthly payment that will become due the Contractor in accordance with the Progress Schedule. The Contractor shall also furnish (a) a detailed estimate giving a complete breakdown of the Contract price, and (b) periodic itemized estimates of work for the purpose of making partial payments thereon. The costs employed in making up any of these Schedules will be used only for determining the basis of partial payments and will not be considered as fixing a basis for additions to or deductions from the Contract price.

12. Mutual Responsibility of Contractors: If, through acts of neglect on the part of the Contractor, any other contractor, or any subcontractor shall suffer loss or damage on the work, the Contractor agrees to settle with such other contractor or subcontractor by agreement or arbitration if such other contractor or subcontractor will so settle. If such other contractor or subcontractor shall assert any claim against the Owner on account of any damage alleged to have been sustained, the Owner shall notify the Contractor, who shall indemnify and save harmless the Owner against any such claim.

13. Extras: Without invalidating the Contract, the Owner may order extra work or make changes by altering, adding to or deducting from the work, the Contract Sum being adjusted accordingly, and the consent of the Surety being first obtained where necessary or desirable. All the work of the kind bid upon shall be paid for at the price stipulated in the Proposal, and no claim for any extra work or materials shall be allowed unless the work is ordered in writing by the Owner or its Engineer, acting officially for the Owner, and the price is stated in such order.

14. Changes in Work: Should the Contractor encounter, or the Owner discover, during the progress of the work subsurface or latent conditions at the site materially differing from those shown on the Drawings or indicated in the Specifications or unknown conditions of an unusual nature differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Drawings and Specifications, the attention of the Owner shall be called immediately to such conditions before they are disturbed. The Owner shall thereupon promptly investigate the conditions, and if it finds that they do so materially differ, the Contract shall be modified, with the written approval of the Owner, to provide for any increase or decrease of cost or difference in time resulting from such conditions. No changes in

work shall be made without prior written approval by the Owner.

The Contractor shall furnish to the Owner when required, an itemized breakdown of the quantities and prices used in computing the value of any change that might be ordered. In figuring changes, instructions for measurement of quantities set forth in the Specifications shall be followed.

Charges or credits for the work covered by the approved change shall be determined by one or more, or a combination of the following methods:

(a) Unit bid prices stipulated in the Proposal or as subsequently approved, which unit prices shall include allowances for overhead and profit.

(b) An agreed lump sum.

(c) The actual cost, by keeping a correct account including all vouchers for:

(1) Labor, including foremen.

(2) Materials entering permanently into the work.

(3) Ownership or rental cost of power tools and construction equipment actually used.

(4) Power and consumable supplies for operation of power equipment.

(5) Pro rata charges for insurance covering Public Liability, Workmen's Compensation, Old Age, and Unemployment, also Social Security.

To the above shall be added a fixed fee for overhead and profit, not to exceed fifteen (15%) per cent of the above items except that actual cost only will be allowed for Social Security, Old Age and Unemployment Insurance. The allowance for combined overhead and profit thus calculated shall be the ONLY such allowance included in the total cost to the Owner. Among the items considered as overhead are costs for insurance other than above, bond, superintendence, timekeeping, clerical work, watchman, use of small tools, general office expense and miscellaneous.

15. Claims for Extra Cost: No claim for extra work or cost shall be allowed, unless the same was done in pursuance of a written order of the Engineer, as aforesaid, and the claim presented with the first estimate after the changed or extra work is done. When work is performed under the terms of subsection 14 (c) of these General Conditions, the Contractor shall furnish satisfactory bills, payrolls and vouchers covering all items of cost and when requested by the Owner, give the Owner access to accounts relating thereto.

16. Materials, Services and Facilities:

(a) It is understood that except as otherwise specifically stated in the Contract Documents, the Contractor shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, superintendence, temporary construction of every nature, and all other services and facilities of every nature whatsoever necessary to execute, complete, and deliver the work within the specified time.

(b) Any work necessary to be performed after regular working hours, on Sundays or Legal Holidays, shall be performed without additional expense to the Owner.

17. Patents:

(a) The Contractor shall hold and save the Owner and its officers, agents, servants, and employees harmless from liability of any nature or kind, including cost and expenses for, or on account of, any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of the Contract, including its use by the Owner, unless otherwise specifically stipulated in the Contract Documents.

(b) If the Contractor uses any design, device or materials covered by letters, patent or copyright, he shall provide for such use by suitable agreement with the Owner of such patented or copyrighted design, device or material. It is mutually agreed and understood that, without exception, the Contract prices shall include all royalties or costs arising from the use of such design, device or materials, in any way involved in the work. The Contractor and/or his sureties shall indemnify and save harmless the Owner of the project from any and all claims for infringement by reason of the use of such patented or copyrighted design, device, or materials or any trademark or copyright in connection with work agreed to be performed under this Contract, and shall indemnify the Owner for any cost, expense or damage which it may be obliged to pay by reason of such infringement at any time during the prosecution of the work or after completion of the work.

18. Inspection and Testing of Materials: Unless otherwise specifically provided for in the Specifications, the inspection and testing of materials and finished articles to be incorporated in the work at the site shall be made by bureaus, laboratories, or agencies arranged for by the Contractor and as approved by the Engineer. The Contractor shall furnish all such extra quantities of materials and items as may be required for testing; and shall deliver same to the laboratory. The cost of furnishing and delivering samples to the laboratory shall be paid for by the Contractor. The Contractor will pay for all laboratory inspection service direct and not as a part of the Contract.

Where the Detailed Specifications call for certified copies of mill or shop tests to establish conformance of certain materials with the Specifications it shall be the responsibility of the Contractor to assure the delivery of such certifications to the Owner.

No materials or finished articles shall be incorporated in the work until such materials and finished articles have passed the required tests. The Contractor shall promptly segregate and remove rejected material and finished articles from the site of the work.

The testing and approval of materials by the laboratory or laboratories approved by the Engineer shall not relieve the Contractor of any of his obligations to fulfill his Contract and guarantee of workmanship and materials as called for in Paragraph 23 herein. The Contractor may, at his option and at his own expense, cause such other tests to be conducted as he may deem necessary to assure suitability, strength, durability of any material or finished article.

19. Right of the Owner to Terminate Contract: In the event that any of the provisions of this Contract are violated by the Contractor, or by any of his

subcontractors, the Owner may serve written notice upon the Contractor and the Surety of its intention to terminate the Contract, such notices to contain the reasons for such intention to terminate the Contract, and, unless within 15 days after the serving of such notice upon the Contractor, such violation or delay shall cease and satisfactory arrangement of correction be made, the Contract shall, upon the expiration of said ten (10) days, cease and terminate. In the event of any such termination, the Owner shall immediately serve notice thereof upon the Surety and the Contractor, and the Surety shall have the right to take over and perform the Contract, provided, however, that if the Surety does not commence performance thereof within five (5) days from the date of the mailing to such Surety of notice of termination, the Owner may take over the work and prosecute the same to completion by contract or by force account for the account and at the expense of the Contractor, and the Contractor and his Surety shall be liable to the Owner for any excess cost occasioned the Owner thereby, and in such event the Owner may take possession of and utilize in completing the work, such materials, appliances, and plant as may be on the site of the work and necessary therefor.

20. Notice and Service Thereof:

(a) Any notice to any Contractor from the Owner relative to any part of this Contract shall be in writing and considered delivered and the service thereof completed, when said notice is posted by registered mail, to the said Contractor at his last given address, or delivered in person to said Contractor or his authorized representative on the work or is deposited in the regular United States mail in a sealed, postage prepaid envelope and the receipt thereof is acknowledged by the Contractor.

(b) All papers required to be delivered to the Owner shall, unless otherwise specified in writing to the Contractor, be delivered to the City Clerk of Athens, Georgia, and any notice to or demand upon the Owner shall be sufficiently given if delivered to the office of said Clerk or if deposited in the United States mail in a sealed, postage prepaid envelope, or delivered with charges prepaid to any telegraph company for transmission, in each case addressed to said Clerk or to such other representative of the Owner, or to such other address as the Owner may subsequently specify in writing to the Contractor for such purposes.

(c) Agent for Service (Foreign Bidders): If the successful bidder is a foreign corporation, partnership or sole proprietorship, the successful bidder hereby irrevocably appoints the Secretary of the State of Georgia as its agent for service of all legal process for the purpose of this Contract only.

21. Quantities of Estimate: The estimated quantities of work to be done and materials to be furnished under this Contract shown in any of the documents including the Proposal, are given for use in comparing bids and to indicate approximately the total amount of the Contract; and the right is especially reserved except as herein otherwise specifically limited, to increase or diminish them as may be deemed reasonably necessary or desirable by the Owner to complete the work contemplated by this Contract.

22. Rights-of-Way and Supension of Work: The Owner will furnish all land and rights-of-way necessary for the carrying out of this Contract and the completion of the work herein contemplated and will use due diligence in acquiring said land and rights-of-way as speedily as possible. But it is possible that

all lands and rights-of-way may not be obtained as herein contemplated before construction begins, in which event the Contractor shall begin his work upon such land and rights-of-way as the Owner may have previously acquired and no claim for damages whatsoever will be allowed by reason of the delay in obtaining the remaining lands and rights-of-way. Should the Owner be prevented or enjoined from proceeding with the work, or from authorizing its prosecution, either before or after the commencement, by reason of any litigation, or by reason of its inability to procure any lands or rights-of-way for the said work, the Contractor shall not be entitled to make or assert any claim for damage by reason of said delay; or to withdraw from the Contract except by consent of the Owner; but time for completion of the work will be extended to such time as the Owner determines will compensate for the time lost by such delay, such determination to be set forth in writing.

23. General Warranty: For a period of at least one year after the completion of the Contract, the Contractor warrants the fitness and soundness of all work done and materials and equipment put in place under the Contract and neither the final certificate of payment nor any provision in the Contract Documents nor partial or entire occupancy of the premises by the Owner shall constitute an acceptance of work not done in accordance with the Contract Documents or relieve the Contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship. The Contractor shall remedy any defects in the work and pay for any damage to other work resulting therefrom, which shall appear within a period of one year from the date of final acceptance of the work unless a longer period is specified. The Owner will give notice of observed defects with reasonable promptness.

24. Contractor's Obligations: The Contractor shall and will, in good workmanlike manner, do and perform all work and furnish all supplies and materials, machinery, equipment, facilities and means, except as herein otherwise expressly specified, necessary or proper and complete all work required by this Contract, within the time herein specified, in accordance with the provisions of this Contract and said Specifications and in accordance with the Plans and Drawings of the work covered by this Contract and any and all supplemental plans and drawings, and in accordance with the directions of the Engineer as given from time to time during the progress of the work. He shall furnish, erect, maintain, and remove such construction plant and such temporary works as may be required. He alone shall be responsible for the safety, efficiency and adequacy of his plant, appliances, and methods, and for any damage which may result from their failure or their improper construction, maintenance, or operation. The Contractor shall observe, comply with, and be subject to all terms, conditions, requirements, and limitations of the Contract and Specifications, and shall do, carry on, and complete the entire work to the satisfaction of the Engineer and the Owner.

25. Engineer's Authority: The Engineer shall give all orders and directions contemplated under this Contract and Specifications relative to the execution of the work. The Engineer shall determine the amount, quality, acceptability, and fitness of the several kinds of work and materials which are to be paid for under the Contract and shall decide all questions which may arise in relation to said work and the construction thereof. The Engineer's estimates and decision shall be final and conclusive, except as herein otherwise expressly provided. In case any question shall arise between the parties hereto relative to said Contract or Specification, the determination or decision of the Engineer shall be a condition precedent to the right of the Contractor to receive any money or payment for work under this Contract affected in any manner or to any

extent by such question.

The Engineer shall decide the meaning and intent of any portion of the Specifications and of any plans or drawings where the same may be found obscure or be in dispute.

Any difference or conflicts in regard to their work which may arise between the Contractor under this Contract and other contractors performing work for the Owner shall be adjusted and determined by the Engineer.

26. "Or Equal" Clause: Whenever a material or article required is specified or shown on the plans by using the name of the proprietory product or of a particular manufacturer or vendor, any material or article which will meet the design criteria and is equal in function and durability, as determined by the Engineer, will be considered acceptable.

27. Prohibited Interests: No official of the Owner who is authorized in such capacity and on behalf of the Owner to negotiate, make, accept or approve, or to take part in negotiating, making, accepting, or approving any architectural, engineering, inspection construction or material supply contract or any subcontract in connection with the construction of this project, shall become directly or indirectly interested personally in this Contract or in any part hereof. No officer, employee, architect, attorney, engineer, or inspector of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory or other similar functions in connection with the construction of the project, shall become directly or indirectly interested personally in this Contract or in any part thereof, any material supply contract, subcontract, insurance contract, or any other contract pertaining to the project.

28. Minimizing Silting and Bank Erosion During Construction: During construction protective measures shall be taken and maintained to minimize bank erosion, and the silting of creeks and rivers adjacent to work being performed during construction.

29. Restoration of Disturbed Areas: All areas disturbed by or during construction shall be restored to their existing or better condition. This is not to be interpreted as to replacement of trees and undergrowth in undeveloped sections of rights-of-way.

30. Bypassing of Sewage: It shall be the Contractor's responsibility to so schedule his work to minimize the bypassing of sewage during construction activities.

31. Evidence of Payment: The Contractor shall furnish the Owner, whenever requested, with satisfactory evidence that all persons who have done work, or furnished materials under this Contract have been duly paid or satisfactorily secured. In case such evidence is not furnished as aforesaid, such amounts as may be necessary to meet the claim of such unsatisfied person may be retained from monies due the Contractor under this Contract, until the liabilities aforesaid shall be fully discharged.

32. Acceptance of Work and Final Payment: Before final acceptance of the work and payment to the Contractor of the percentage retained by the Owner, the following requirements shall be complied with:

(a) Final Inspection: Upon notice from the Contractor that his work is

completed, the Engineer will make a final inspection of the work, and shall notify the Contractor of all instances where his work fails to comply with the Contract Drawings and Specifications, as well as any defects he may discover. The Contractor shall immediately make such alterations as are necessary to make the work comply with the Contract Drawings and Specifications, and to the satisfaction of the Engineer.

(b) Operating Test: After the alterations for compliance with the Contract Drawings and Specifications have been made, and before acceptance of the whole or any part of the work, it shall be subjected to test to determine that it is in accordance with the Contract Drawings and Specifications. The Contractor shall maintain all work in first-class condition for a thirty (30) day operating period after the work has been completed as a whole, the final inspection has been made and the Engineer has notified the Contractor in writing that the work has been finished to his satisfaction. Necessary power, chemicals and materials required for operation will be furnished by the Owner during the specified operation period. The retained percentage as provided herein will not become due or payable to the Contractor until after the thirty (30) days operating period has expired.

(c) Cleaning Up: Before the work is considered as complete, all rubbish and unused material due to or connected with the construction must be removed and the premises left in a condition satisfactory to the Owner. Streets, curbs, cross-walks, pavements, sidewalks, fence and other public and private property disturbed or damaged shall be restored to their former condition. Final acceptance will be withheld until such work is finished.

(d) Liens: Final acceptance of the work will not be granted and the retained percentage will not be due or payable until the Contractor has furnished the Owner proper and satisfactory evidence under oath that all claims for labor and material employed or used in the construction of the work under this Contract have been settled, and that no legal claims can be filed against the Owner for such labor or material.

(e) Final Estimate: Upon completion of all cleaning up, alterations and repairs required by the Final Inspection or Operating Test, the satisfactory completion of the operating test, and upon submitting proper and satisfactory evidence to the Owner that all claims have been settled, the Engineer will issue a certificate of final acceptance of the work. The Contractor shall then prepare his final estimate. After review and approval of the Final Estimate by the Engineer, and the Owner, the payment shall then become due, subject, however, to the provisions for notice of completion required by Georgia statutes.

33. Wage Rates: Wage rates shall be not less than those established in the Wage Determination issued by the U. S. Department of Labor.

34. Inspection by Agencies: The representatives of the Department of Housing and Urban Development and of the Environmental Protection Division of the Georgia Department of Natural Resources shall have access to the work wherever it is, in preparation or progress, and the Contractor shall provide proper facilities for such access and inspection.

35. Acceptance of Final Payment: The submission of the final estimate to the Owner, and the acceptance of payment for same, shall operate as a release to the Owner for all claims and liabilities to the Contractor for all work done or materials furnished or for any act of the Owner or its agents affecting the work.

36. Guarantee: The Contractor shall guarantee all work performed under this Contract against defective workmanship or materials, and shall replace all such defective work, materials or equipment, for a period of one year from the date of final acceptance of the work.

U. S. Department of Housing and Urban Development
Community Development Block Grant Program
FEDERAL LABOR STANDARDS PROVISIONS

1. APPLICABILITY

The Project or Program to which the work covered by this Contract pertains is being assisted by the United States of America and the following Federal Labor Standards Provisions are included in this Contract pursuant to the provisions applicable to such Federal assistance.

2. MINIMUM WAGE RATES FOR LABORERS AND MECHANICS

All laborers and mechanics employed upon the work covered by this Contract shall be paid unconditionally and not less often than once each week, and without subsequent deduction or rebate on any account (except such payroll deductions as are made mandatory by law and such other payroll deductions as are permitted by the applicable regulations issued by the Secretary of Labor, United States Department of Labor, pursuant to the Anti-Kickback Act hereinafter identified), the full amount due at time of payment computed at wage rates not less than those contained in the wage determination decision of said Secretary of Labor (a copy of which is attached and herein incorporated by reference), regardless of any contractual relationship which may be alleged to exist between the Contractor or any subcontractor and such laborers and mechanics. All laborers and mechanics employed upon such work shall be paid in cash, except that payment may be by check if the employer provides or secures satisfactory facilities approved by the Local Public Agency or Public Body for the cashing of the same without cost or expense to the employee. For the purpose of this clause, contributions made or costs reasonably anticipated under Section 1 (b) (2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of Section 5.5(a)(1)(iv) of Title 29, Code of Federal Regulations. Also for the prupose of this clause, regular contributions made or costs incurred for more than a weekly period under plans, funds, or programs, but covering the particular weekly period, are deemed to be constructively made or incurred during such weekly period.

3. UNDERPAYMENTS OF WAGES OR SALARIES

In case of underpayment of wages by the Contractor or by any subcontractor to laborers or mechanics employed by the Contractor or subcontractor upon the work covered by this Contract, the Local Public Agency or Public Body in addition to such other rights as may be afforded it under this Contract shall withhold from the Contractor, out of any payments due the Contractor, so much thereof as the Local Public

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Agency or Public Body may consider necessary to pay such laborers or mechanics the full amount of wages required by this Contract. The amount so withheld may be disbursed by the Local Public Agency or Public Body, for and on account of the Contractor or the subcontractor (as may be appropriate), to the respective laborers or mechanics to whom the same is due or on their behalf to plans, funds, or programs for any type of fringe benefit prescribed in the applicable wage determination.

4. ANTICIPATED COSTS OF FRINGE BENEFITS

If the Contractor does not make payments to a trustee or other third person, he may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing fringe benefits under a plan or program of a type expressly listed in the wage determination decision of the Secretary of Labor which is a part of this Contract: Provided, however, The Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program. A copy of any findings made by the Secretary of Labor in respect to fringe benefits being provided by the Contractor must be submitted to the Local Public Agency or Public Body with the first payroll filed by the Contractor subsequent to receipt of the findings.

5. OVERTIME COMPENSATION REQUIRED BY CONTRACT WORK HOURS AND SAFETY STANDARDS ACT (76 Stat. 357-360: Title 40 U.S.C., Sections 327-332)

(a) Overtime requirements. No Contractor or subcontractor contracting for any part of the Contract work which may require or involve the employment of laborers or mechanics, including watchmen and guards, shall require or permit any laborer or mechanic in any workweek in which he is employed on such work to work in excess of 8 hours in any calendar day or in excess of 40 hours in such work week unless such laborer or mechanic receives compensation at a rate not less than one and one-half times his basic rate of pay for all hours worked in excess of 8 hours in any calendar day or in excess of 40 hours in such work week, as the case may be.

(b) Violation: liability for unpaid wages liquidated damages. In the event of any violation of the clause set forth in paragraph (a), the Contractor and any subcontractor responsible therefor shall be liable to any affected employee for his unpaid wages. In addition, such Contractor and subcontractor shall be liable to the United States for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic employed in violations of the clause set forth in paragraph (a), in the sum of $10 for each calendar day on which such employee was required or permitted to work

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in excess of 8 hours or in excess of the standard workweek of 40 hours without payment of the overtime wages required by the clause set forth in paragraph (a).

(c) Withholding for liquidated damages. The Local Public Agency or Public Body shall withhold or cause to be withheld, from any moneys payable on account of work performed by the Contractor or subcontractor, such sums as may administratively be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for liquidated damages as provided in the clause set forth in paragraph (b).

(d) Subcontracts. The Contractor shall insert in any subcontracts the clauses set forth in paragraphs (a), (b), and (c) of this Section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts which they may enter into, together with a clause requiring this insertion in any further subcontracts that may in turn be made.

6. EMPLOYMENT OF APPRENTICES/TRAINEES

(a) Apprentices will be permitted to work as such only when they are registered, individually, under a bona fide apprenticeship program registered with a State apprenticeship agency which is recognized by the Bureau of Apprenticeship and Training, U. S. Department of Labor; or, if no such recognized agency exists in a State, under a program registered with the Bureau of Apprenticeship and Training, U. S. Department of Labor. The allowable ratio of apprentices to journeymen in any craft classification shall not be greater than the ratio permitted to the Contractor as to his entire work force under the registered program. Any employee listed on a payroll at an apprentice wage rate, who is not a trainee as defined in subsection (b) immediately following or is not registered as above, shall be paid the wage rate determined by the Secretary of Labor for the classification of work he actually performed. The Contractor or Subcontractor will be required to furnish to the Local Public Agency or Public Body written evidence of the registration of his program and apprentices as well as of the appropriate ratios and wage rates, for the area of construction prior to using any apprentices on the contract work.

(b) Trainees will be permitted to work as such when they are bona fide trainees employed pursuant to a program approved by the U. S. Department of Labor, Manpower Administration, Bureau of Apprenticeship and Training, and where subsection (c) immediately following is applicable, in accordance with the provisions of 29 CFR 5a.

(c) On contracts in excess of $10,000 the employment of all laborers and mechanics, including apprentices and trainees, as defined in 29 CFR Part 5.2(c) shall also be subject to the provisions of 6(d) of this section.

(d) The Contractor agrees that:

(1) He will make a diligent effort to hire for the performance of the contract a number of apprentices or trainees, or both, in each occupation, which bears to the average number of journeymen in that occupation to be employed in the performance of the contract the applicable ratio as determined by the Secretary of Labor;

(2) He will assure that 25 percent of such apprentices or trainees in such occupation are in their first year of training, where feasible. Feasibility here involves a consideration of (a) the availability of training opportunities for first year apprentices, (b) the hazardous nature of the work for beginning workers, (c) excessive unemployment of apprentices in their second and subsequent years of training;

(3) During the performance of the contract he will, to the greatest extent possible, employ the number of apprentices or trainees necessary to meet currently the requirements of (1) and (2) immediately preceding;

(4) He will maintain records of employment by trade of the number of apprentices and trainees, apprentices and trainees by first year of training, and of journeymen, and the wages paid and hours of work of such apprentices, trainees and journeymen; and he will make these records available for inspection upon request of the Department of Labor and the agency;

(5) If he claims compliance based on the criterion stated in 29 CFR 5a.4(b), he will maintain records of employment, as described in the immediately preceding paragraph, on non-Federal and nonfederally assisted construction work done during the performance of the contract in the same labor market area; and he will make these records available for inspection upon request of the Department of Labor and the agency;

(6) He will supply one copy of the written notices required in accordance with 29 CFR 5a.4(c) at the request of Government compliance officers, and will supply at 3-month intervals during the performance of the contract and after completion of contract performance a statement describing steps taken toward making a diligent effort and containing a breakdown by craft, of hours worked and wages paid for first year apprentices and trainees, other apprentices and trainees, and journeymen. One copy of the statement will be sent to the agency and one to the Secretary of Labor.

7. EMPLOYMENT OF CERTAIN PERSONS PROHIBITED

No person under the age of sixteen years and no person who, at the time, is serving sentence in a penal or correctional institution shall be employed on the work covered by this Contract.

8. REGULATIONS PURSUANT TO SO-CALLED "ANTI-KICKBACK ACT"

The Contractor shall comply with the applicable regulations (a copy of which is attached and herein incorporated by reference) of the Secretary of Labor, United States Department of Labor, made pursuant to the so-called "Anti-Kickback Act" of June 13, 1934 (48 Stat. 948: 62 Stat. 862; Title U.S.C., Section 874: and Title 40 U.S.C., Section 276c), and any amendments or modifications thereof, shall cause appropriate provisions to be inserted in subcontracts to insure compliance therewith by all subcontractors subject thereto, and shall be responsible for the submission of affidavits required by subcontractors thereunder, except as said Secretary of Labor may specifically provide for reasonable limitations, variations, tolerances, and exemptions from the requirements thereof.

9. EMPLOYMENT OF LABORERS OR MECHANICS NOT LISTED IN AFORESAID WAGE DETERMINATION DECISION

Any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the Contract will be classified or reclassified conformably to the wage determination by the Local Public Agency or Public Body, and a report of the action taken shall be submitted by the Local Public Agency or Public Body, through the Secretary of Housing and Urban Development, to the Secretary of Labor, United States Department of Labor. In the event the interested parties cannot agree on the proper classification or reclassification of a particular class of laborers and mechanics to be used, the question accompanied by the recommendation of the Local Public Agency or Public Body shall be referred, through the Secretary of Housing and Urban Development, to the Secretary of Labor for final determination.

10. FRINGE BENEFITS NOT EXPRESSED AS HOURLY WAGE RATES

The Local Public Agency or Public Body shall require, whenever the minimum wage rate prescribed in the Contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly wage rate and the Contractor is obligated to pay cash equivalent of such a fringe benefit, an hourly cash equivalent thereof to be established. In the event the interested parties cannot agree upon a cash equivalent of the fringe benefit, the question, accompanied by the recommendation of the Local Public Agency or Public Body, shall be referred, through the Secretary of Housing and Urban Development, to the Secretary of Labor for determination.

11. POSTING WAGE DETERMINATION DECISIONS AND AUTHORIZED WAGE DEDUCTIONS

The applicable wage poster of the Secretary of Labor, United States Department of Labor, and the applicable wage determination decisions of said Secretary of Labor with respect to the various classification of laborers and mechanics employed and to be employed upon the work covered by this Contract, and a statement showing all deductions, if any, in accordance with the provisions of this Contract, to be made from wages actually earned by persons so employed or to be employed in such classifications, shall be posted at appropriate conspicuous points at the site of the work.

12. COMPLAINTS, PROCEEDINGS, OR TESTIMONY BY EMPLOYEES

No laborer or mechanic to whom the wage, salary, or other labor standards provisions of this Contract are applicable shall be discharged or in any other manner discriminated against by the Contractor or any subcontractor because such employee has filed any complaint or instituted or caused to be instituted any proceeding or has testified or is about to testify in any proceeding under or relating to the labor standards applicable under this Contract to his employer.

13. CLAIMS AND DISPUTES PERTAINING TO WAGE RATES

Claims and disputes pertaining to wage rates or to classifications of laborers and mechanics employed upon the work covered by this Contract shall be promptly reported by the Contractor in writing to the Local Public Agency or Public Body for referral by the latter through the Secretary of Housing and Urban Development to the Secretary of Labor, United States Department of Labor, whose decision shall be final with respect thereto.

14. QUESTIONS CONCERNING CERTAIN FEDERAL STATUTES AND REGULATIONS

All questions arising under this Contract which relate to the application or interpretation of (a) the aforesaid Anti-Kickback Act, (b) the Contract Work Hours and Safety Standards Act, (c) the aforesaid Davis-Bacon Act, (d) the regulations issued by the Secretary of Labor, United States Department of Labor, pursuant to said Acts, or (c) the labor standards provisions of any other pertinent Federal statute, shall be referred, through the Local Public Agency or Public Body and the Secretary of Housing and Urban Development, to the Secretary of Labor, United States Department of Labor, for said Secretary's appropriate ruling or interpretation which shall be authoritative and may be relied upon for the purposes of this Contract.

15. PAYROLLS AND BASIC PAYROLL RECORDS OF CONTRACTOR AND SUBCONTRACTORS

The Contractor and each subcontractor shall prepare his payrolls on forms satisfactory to and in accordance with instructions to be

furnished by the Local Public Agency or Public Body. The Contractor shall submit weekly to the Local Public Agency or Public Body two certified copies of all payrolls of the Contractor and of the subcontractors, it being understood that the Contractor shall be responsible for the submission of copies of payrolls of all subcontractors. Each such payroll shall contain the "Weekly Statement of Compliance" set forth in Section 3.3 of Title 29, Code of Federal Regulations. The payrolls and basic payroll records of the Contractor and each subcontractor covering all laborers and mechanics employed upon the work covered by this Contract shall be maintained during the course of the work and preserved for a period of 3 years thereafter. Such payrolls and basic payroll records shall contain the name and address of each such employee, his correct classification, rate of pay (including rates of contributions or costs anticipated of the types described in Section 1(b)(2) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made, and actual wages paid. In addition, whenever the Secretary of Labor has found under Section 5.5(a)(1)(iv) of Title 29, Code of Federal Regulations, that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in Section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor or subcontractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. The Contractor and each subcontractor shall make his employment records with respect to persons employed by him upon the work covered by this Contract available for inspection by authorized representatives of the Secretary of Housing and Urban Development, the Local Public Agency or Public Body, and the United States Department of Labor. Such representatives shall be permitted to interview employees of the Contractor or of any subcontractor during working hours on the job.

16. SPECIFIC COVERAGE OF CERTAIN TYPES OF WORK BY EMPLOYEES

The transporting of materials and supplies to or from the site of the Project or Program to which this Contract pertains by the employees of the Contractor or of any subcontractor, and the manufacturing or furnishing of materials, articles, supplies, or equipment on the site of the Project or Program to which this Contract pertains by persons employed by the Contractor or by any subcontractor, shall, for the purposes of this Contract, and without limiting the generality of the foregoing provisions of this Contract, be deemed to be work to which these Federal Labor Standards Provisions are applicable.

17. INELIGIBLE SUBCONTRACTORS

The Contractor shall not subcontract any part of the work covered by this Contract or permit subcontracted work to be further subcontracted

without the Local Public Agency's or Public Body's prior written approval of the subcontractor. The Local Public Agency or Public Body will not approve any subcontractor for work covered by this Contract who is at the time ineligible under the provisions of any applicable regulations issued by the Secretary of Labor, United States Department of Labor or the Secretary of Housing and Urban Development, to receive an award of such subcontract.

18. PROVISIONS TO BE INCLUDED IN CERTAIN SUBCONTRACTS

The Contractor shall include or cause to be included in each subcontract covering any of the work covered by this Contract, provisions which are consistent with these Federal Labor Standards Provisions and also a clause requiring the subcontractors to include such provisions in any lower tier subcontracts which they may enter into, together with a clause requiring such insertion in any further subcontracts that may in turn be made.

19. BREACH OF FOREGOING FEDERAL LABOR STANDARDS PROVISIONS

In addition to the causes for termination of this Contract as herein elsewhere set forth, the Local Public Agency or Public Body reserves the right to terminate this Contract if the Contractor or any subcontractor whose subcontract covers any of the work covered by this Contract shall breach any of these Federal Labor Standards Provisions. A breach of these Federal Labor Standards Provisions may also be grounds for debarment as provided by the applicable regulations issued by the Secretary of Labor, United States Department of Labor.

ATTACHMENT TO FEDERAL LABOR STANDARDS PROVISIONS

SO-CALLED "ANTI-KICKBACK ACT" AND REGULATIONS PROMULGATED PURSUANT THERETO BY THE SECRETARY OF LABOR, UNITED STATES DEPARTMENT OF LABOR

TITLE 18, U.S.C., section 874

(Replaces section 1 of the Act of June 13, 1934 (48 Stat. 948, 40 U.S.C., sec. 276b) pursuant to the Act of June 25, 1948, 62 Stat. 862)

KICKBACKS FROM PUBLIC WORKS EMPLOYEES

Whoever, by force, intimidation, or threat of procuring dismissal from employment, or by any other manner whatsoever induces any person employed in the construction, prosecution, completion or repair of any public building, public work, or building or work financed in whole or in part by loans or grants from the United States, to give up any part of the compensation to which he is entitled under his contract of employment, shall be fined not more than $5,000 or imprisoned not more than five years, or both.

SECTION 2 OF THE ACT OF JUNE 13, 1934, AS AMENDED (48 Stat. 948, 62 Stat. 862, 63 Stat. 108, 72 Stat. 967, 40 U.S.C., sec. 276c)

The Secretary of Labor shall make reasonable regulations for contractors and subcontractors engaged in the construction, prosecution, completion or repair of public buildings, public works or buildings or works financed in whole or in part by loans or grants from the United States, including a provision that each contractor and subcontractor shall furnish weekly a statement with respect to the wages paid each employee during the preceding week. Section 1001 of Title 18 (United States Code) shall apply to such statements.

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Pursuant to the aforesaid Anti-Kickback Act, the Secretary of Labor, United States Department of Labor, has promulgated the regulations hereinafter set forth, which regulations are found in Title 29, Subtitle A, Code of Federal Regulations, Part 3. The term "this part," as used in the regulations hereinafter set forth, refers to Part 3 last above mentioned. Said regulations are as follows:

TITLE 29 – LABOR

Subtitle A – Office of the Secretary of Labor

PART 3–CONTRACTORS AND SUBCONTRACTORS ON PUBLIC BUILDING OR PUBLIC WORK FINANCED IN WHOLE OR IN PART BY LOANS OR GRANTS FROM THE UNITED STATES

Section 3.1 Purpose and scope.

This part prescribes "anti-kickback" regulations under section 2 of the Act of June 13, 1934, as amended (40 U.S.C. 276c), popularly known as the Copeland Act. This part applies to any contract which is subject to Federal wage standards and which is for the construction, prosecution, completion, or repair of public buildings, public works or buildings or works financed in whole or in part by loans or grants from the United States. The part is intended to aid in the enforcement of the minimum wage provisions of the Davis-Bacon Act and the various statutes dealing with Federally-assisted construction that contain similar minimum wage provisions, including those provisions which are not subject to Reorganization Plan No. 14

(e.g., the College Housing Act of 1950, the Federal Water Pollution Control Act, and the Housing Act of 1959), and in the enforcement of the overtime provisions of the Contract Work Hours Standards Act whenever they are applicable to construction work. The part details the obligation of contractors and subcontractors relative to the weekly submission of statements regarding the wages paid on work covered thereby; sets forth the circumstances and procedures governing the making of payroll deductions from the wages of those employed on such work; and delineates the methods of payment permissible on such work.

Section 3.2 Definitions.

As used in the regulations in this part:

(a) The terms "building" or "work" generally include construction activity as distinguished from manufacturing, furnishing of materials, or servicing and maintenance work. The terms include, without limitation, buildings, structures, and improvements of all types, such as bridges, dams, plants, highways, parkways, streets, subways, tunnels, sewers, mains, powerlines, pumping stations, railways, airports, terminals, docks, piers, wharves, ways, lighthouses, buoys, jetties, breakwaters, levees, and canals; dredging, shoring, scaffolding, drilling, blasting, excavating, clearing, and landscaping. Unless conducted in connection with and at the site of such a building or work as is described in the foregoing sentence, the manufacture or furnishing of materials, articles, supplies, or equipment (whether or not a Federal or State agency acquires title to such materials, articles, supplies, or equipment during the course of the manufacture or furnishing, or owns the materials from which they are manufactured or furnished) is not a "building" or "work" within the meaning of the regulations in this part.

(b) The terms "construction," "prosecution," "completion," or "repair" mean all types of work done on a particular building or work at the site thereof, including, without limitation, altering, remodeling, painting and decorating, the transporting of materials and supplies to or from the building or work by the employees of the construction contractor or construction subcontractor, and the manufacturing or furnishing of materials, articles, supplies, or equipment on the site of the building or work, by persons employed at the site by the contractor or subcontractor.

(c) The terms "public building" or "public work" include building or work for whose construction, prosecution, completion, or repair, as defined above, a Federal agency is a contracting party, regardless of whether title thereof is in a Federal agency.

(d) The term "building or work financed in whole or in part by loans or grants from the United States" includes building or work for whose construction, prosecution, completion, or repair, as defined above, payment or part payment is made directly or indirectly from funds provided by loans or grants by a Federal agency. The term does not include building or work for which Federal assistance is limited solely to loan guarantees or insurance.

(e) Every person paid by a contractor or subcontractor in any manner for his labor in the construction, prosecution, completion, or repair of a public building or public work or building or work financed in whole or in part by loans or grants from the United States is "employed" and receiving "wages," regardless of any contractual relationship alleged to exist between him and the real employer.

(f) The term "any affiliated person" includes a spouse, child, parent, or other close relative of the contractor or subcontractor; a partner or officer of the contractor or subcontractor; a corporation closely connected with the contractor or subcontractor as parent, subsidiary or otherwise, and an officer or agent of such corporation.

(g) The term "Federal agency" means the United States, the District of Columbia, and all executive departments, independent establishments, administrative agencies, and instrumentalities of the United States and of the District of Columbia, including corporations, all or substantially all of the stock of which is beneficially owned by the United States, by the District of Columbia, or any of the foregoing departments, establishments, agencies, and instrumentalities.

Section 3.3 Weekly statement with respect to payment of wages.

(a) As used in this section, the term "employee" shall not apply to persons in classifications higher than that of laborer or mechanic and those who are the immediate supervisors of such employees.

(b) Each contractor or subcontractor engaged in the construction, prosecution, completion, or repair of any public building or public work, or building or work financed in whole or in part by loans or grants from the United States, shall furnish each week a statement with respect to the wages paid each of its employees engaged on work covered by 29 CFR Parts 3 and 5 during the preceding weekly payroll period. This statement shall be executed by the contractor or subcontractor or by an authorized officer or employee of the contractor or subcontractor who supervises the payment of wages, and shall be on form WH 348, "Statement of Compliance", or on an identical form on the back of WH 347, "Payroll (For Contractors Optional Use)" or on any form with identical wording. Sample copies of WH 347 and WH 348 may be obtained from the Government contracting or sponsoring agency, and copies of these forms may be purchased at the Government Printing Office.

(c) The requirements of this section shall not apply to any contract of $2,000 or less.

(d) Upon a written finding by the head of a Federal agency, the Secretary of Labor may provide reasonable limitations, variations, tolerances, and exemptions from the requirements of this section subject to such conditions as the Secretary of Labor may specify.

[29 F.R. 95, Jan. 4, 1964, as amended at 33 F.R. 10186, July 17, 1968]

Section 3.4 Submission of weekly statements and the preservation and inspection of weekly payroll records.

(a) Each weekly statement required under § 3.3 shall be delivered by the contractor or subcontractor, within seven days after the regular payment date of the payroll period, to a representative of a Federal or State agency in charge at the site of the building or work, or, if there is no representative of a Federal or State agency at the site of the building or work, the statement shall be mailed by the contractor or subcontractor, within such time, to a Federal or State agency contracting for or financing the building or work. After such examination and check as may be made, such statement, or a copy thereof, shall be kept available, or shall be transmitted together with a report of any violation, in accordance with applicable procedures prescribed by the United States Department of Labor.

(b) Each contractor or subcontractor shall preserve his weekly payroll records for a period of three years from date of completion of the contract. The payroll records shall set out accurately and completely the name and address of each laborer and mechanic, his correct classification, rate of pay, daily and weekly number of hours worked, deductions made, and actual wages paid. Such payroll records shall be made available at all times for inspection by the contracting officer or his authorized representative, and by authorized representatives of the Department of Labor.

Section 3.5 Payroll deductions permissible without application to or approval of the Secretary of Labor.

Deductions made under the circumstances or in the situations described in the paragraphs of this section may be made without application to and approval of the Secretary of Labor:

(a) Any deduction made in compliance with the requirements of Federal, State, or local law, such as Federal or State withholding income taxes and Federal social security taxes.

(b) Any deduction of sums previously paid to the employee as a bona fide prepayment of wages when such prepayment is made without discount or interest. A "bona fide prepayment of wages" is considered to have been made only when cash or its equivalent has been advanced to the person employed in such manner as to give him complete freedom of disposition of the advanced funds.

(c) Any deduction of amounts required by court process to be paid to another, unless the deduction is in favor of the contractor, subcontractor or any affiliated person, or when collusion or collaboration exists.

(d) Any deduction constituting a contribution on behalf of the person employed to funds established by the employer or representatives of employees, or both, for the prupose of providing either from principal or income, or both, medical or hospital care, pensions or annuities on retirement, death benefits, compensation for injuries, illness, accidents, sickness, or disability, or for insurance to provide any of the foregoing, or unemployment benefits, vacation pay, savings accounts, or similar payments for the benefit of employees, their families and dependents: *Provided, however,* That the following standards are met: (1) The deduction is not otherwise prohibited by law; (2) it is either: (i) Voluntarily consented to by the employee in writing and in advance of the period in which the work is to be done and such consent is not a condition either for the obtaining of or for the continuation of employment, or (ii) provided for in a bona fide collective bargaining agreement between the contractor or subcontractor and representatives of its employees; (3) no profit or other benefit is otherwise obtained, directly or indirectly, by the contractor or subcontractor or any affiliated person in the form of commission, dividend, or otherwise; and (4) the deductions shall serve the convenience and interest of the employee.

(e) Any deduction contributing toward the purchase of United States Defense Stamps and Bonds when voluntarily authorized by the employee.

(f) Any deduction requested by the employee to enable him to repay loans to or to purchase shares in credit unions organized and operated in accordance with Federal and State credit union statutes.

(g) Any deduction voluntarily authorized by the employee for the making of contributions to governmental or quasi-governmental agencies, such as the American Red Cross.

(h) Any deduction voluntarily authorized by the employee for the making of contributions to Community Chests, United Givers Funds, and similiar charitable organizations.

(i) Any deductions to pay regular union initiation fees and membership dues, not including fines or special assessments: *Provided, however,* That a collective bargaining agreement between the contractor or subcontractor and representatives of its employees provides for such deductions and the deductions are not otherwise prohibited by law.

(j) Any deduction not more than for the "reasonable cost" of board, lodging, or other facilities meeting the requirements of section 3(m) of the Fair Labor Standards Act of 1938, as amended, and Part 531 of this title. When such a deduction is made the additional records required under § 516.27 (a) of this title shall be kept.

Section 3.6 Payroll deductions permissible with the approval of the Secretary of Labor.

Any contractor or subcontractor may apply to the Secretary of Labor for permission to make any deduction not permitted under § 3.5. The Secretary may grant permission whenever he finds that:

(a) The contractor, subcontractor, or any affiliated person does not make a profit or benefit directly or indirectly from the deduction either in the form of a commission, dividend, or otherwise;

(b) The deduction is not otherwise prohibited by law;

(c) The deduction is either (1) voluntarily consented to by the employee in writing and in advance of the period in which the work is to be done and such consent is not a condition either for the obtaining of employment or its continuance, or (2) provided for in a bona fide collective bargaining agreement between the contractor or subcontractor and representatives of its employees; and

(d) The deduction serves the convenience and interest of the employee.

Section 3.7 Applications for the approval of the Secretary of Labor.

Any application for the making of payroll deductions under § 3.6 shall comply with the requirements prescribed in the following paragraphs of this section:

(a) The application shall be in writing and shall be addressed to the Secretary of Labor.

(b) The application shall identify the contract or contracts under which the work in question is to be performed. Permission will be given for deductions only on specific, identified contracts, except upon a showing of exceptional circumstances.

(c) The application shall state affirmatively that there is compliance with the standards set forth in the provisions of § 3.6. The affirmation shall be accompanied by a full statement of the facts indicating such compliance.

(d) The application shall include a description of the proposed deduction, the purpose to be served thereby, and the classes of laborers or mechanics from whose wages the proposed deduction would be made.

(e) The application shall state the name and business of any third person to whom any funds obtained from the proposed deductions are to be transmitted and the affiliation of such person, if any, with the applicant.

Section 3.8 Action by the Secretary of Labor upon applications.

The Secretary of Labor shall decide whether or not the requested deduction is permissible under provisions of § 3.6, and shall notify the applicant in writing of his decision.

Section 3.9 Prohibited payroll deductions.

Deductions not elsewhere provided for by this part and which are not found to be permissible under § 3.6 are prohibited.

Section 3.10 Methods of payment of wages.

The payment of wages shall be by cash, negotiable instruments payable on demand, or the additional forms of compensation for which deductions are permissible under this part. No other methods of payment shall be recognized on work subject to the Copeland Act.

Section 3.11 Regulations part of contract.

All contracts made with respect to the construction, prosecution, completion, or repair of any public building or public work or building or work financed in whole or in part by loans or grants from the United States covered by the regulations in this part shall expressly bind the contractor or subcontractor to comply with such of the regulations in this part as may be applicable. In this regard, see § 5.5 (a) of this subtitle.

☆ G. P. O. 1975 — 641-224 / 69. REGION NO. 4

DETAILED SPECIFICATIONS

SECTION NO. 1

GENERAL AND DETAILED REQUIREMENTS

ALL DIVISIONS

1.01 Scope: This Section of Specifications consists of the General Requirements applicable to all Divisions of the work.

1.02 Drawings: The set of Drawings entitled "City of Athens, Georgia, Water System Improvements, Division One", Sheets 1 through 13, dated August, 1976 shall form a part of the Division One contract.

The set of Drawings entitled "City of Athens, Georgia, Water Works Improvements, Division Two", Sheets 1 through 58, dated August, 1976 shall form a part of the Division Two contract.

1.03 Specifications: The Detailed Specifications for work to be done under Division One which shall form a part of that contract, include this Section of Specifications and Section 14. In addition, miscellaneous items not specified in these sections shall conform to the requirements of Division Two Specifications.

The Detailed Specifications for work to be done under Division Two which shall form a part of that contract, include this Section of Specifications and Sections 2 through Section 14.

1.04 Work to be Done: Work to be done under Division One of the Contract shall consist of furnishing all material except as specified herein, all labor, tools, construction equipment, of whatever nature, necessary to construct and put in complete working order the pipe lines and appurtenances shown on the Drawings and specified. The work shall include all clearing, trenching and excavation, pumping, bailing and draining, sheeting, pipe laying, backfilling, flushing, testing and sterilization of lines and all provisions necessary to protect and maintain buildings, fences, water and gas lines, power and telephone lines and cables, drainage and other structures, the furnishing and maintenance of suitable bridges and footways across intercepted streets, alleys and walkways, the replacing of street pavement, the cleaning away of all rubbish and surplus excavated material, and all such other work as may be necessary to complete the project.

Work to be done under Division Two of the contract consists of furnishing all materials and equipment and performing all labor necessary for all general structural and building work complete, including constructing settling basins, filters, chemical application facilities, piping, mechanical equipment, metering, instrumentation, electrical, and all other work and appurtenances shown on the Drawings and/or specified to be a part of the work under this Division of the contract. All sections of Specifications apply to Division Two.

No fabrication, erection, or installation of work listed above shall commence until drawings and details have been approved by the Engineer.

(a) Check by Contractor: The Contractor shall check all Working Drawings for accuracy of dimensions and details and for conformation with Contract Drawings and Specifications before submitting such Drawings to the Engineer for approval. The Contractor shall indicate that Working Drawings as outlined above have been checked by him by an appropriate stamp or notation of the face of those Drawings.

(b) Responsibility for Accuracy: Approval by the Engineer of the Contractor's Working Drawings shall not relieve the Contractor for accuracy of dimensions and details. The Contractor shall be responsible for agreement and conformity of Working Drawings with Contract Drawings and Specifications.

(c) Payment: The contract price shall include the cost of furnishing all Working Drawings. The Contractor shall be allowed no extra compensation for furnishing Working Drawings.

1.05 Pre-Construction Conference: Prior to commencing work under any Division a pre-construction conference will be held at the office of the Owner, at which time the order and schedule for completion of the work will be presented by the Contractor. The items needed for the completion of the schedule are as follows:

(a) Schedule for submission and approval of Working Drawings.

(b) Firm delivery schedule for materials and equipment to be incorporated in the work.

(c) Complete schedule of work and monthly partial payments anticipated by the Contractor.

(d) Estimate forms.

The Engineer will advise the Contractor of inspection procedures and requirements for testing.

1.06 Limits: The limits of each Division of work are shown on the drawings.

1.07 Cooperation Between Contractors: Each Contractor is reminded that it is his responsibility to the Owner to cooperate with the other contractors involved in this work. No contractor shall lay out his work so as to restrict the access of another contractor. Storage areas at the sites will be allowed to each division of work by the Owner.

1.08 Work and Materials by the Owner: The Owner will furnish all water for testing and construction operations at the nearest existing hydrant to the work or at his option may provide a tap for the Contractor. The Contractor shall furnish all hoses, tanks and other means for conveying water from the hydrant, or tap of the Owner. The Owner will furnish chemicals and supervise the sterilization process. The Contractor shall furnish the necessary labor for sterilization. The Owner's forces will operate all existing valves required to be operated and will supervise all taps and connections to existing lines made by the Contractor's forces.

1.09 Maintenance of Water Supply: All work involving the temporary or permanent removal of existing facilities from service shall be in accordance with a

schedule approved by the Owner. The Contractor shall notify the Owner and obtain his permission in advance of beginning any such work. Under no circumstances shall the Contractor undertake any procedure which will hazard the water supply of the Owner.

1.10 Order and Schedule of Work: The Contractor shall prepare a written construction schedule for the approval of the Engineer prior to beginning construction. The Contractor shall take into consideration the following requirements in the preparation of his construction schedule.

(a) Division One: Work shall be scheduled to cause the least interruption of traffic. At the Owner's option, connections to the existing system may be required to be made at night or on weekends.

(b) Division Two: The water treatment facilities must remain in service during the progress of construction. The work shall be scheduled to include the following general sequence:

(1) Relocate high service and raw water lines in the vicinity of the filter building.

(2) Make connection to existing 30" raw water line during off-production period and return line to service as soon as possible. Plant shall be fed by the two 20-inch lines while the connection is being made.

(3) Proceed with all blasting in the chemical building area during off peak production periods in spring and winter.

(4) New raw water flash mixer, settling basins and piping to existing filters shall be in service prior to commencing work on the existing settling basins.

(5) Disconnect and salvage temporary 20-inch raw water line during an off peak period after new line through post chemical building is in service.

1.11 Wrecking: Existing structures in the area of the new settling basins shall be wrecked either prior to or during the excavation for the new work. The wall between the control room and the post line feeder room shall be removed. The windows and the roll-up door in the post lime feeder room shall be removed and replaced with new windows as shown on the Drawings. The Contractor shall, at his own expense, immediately repair any and all damage to the existing facilities that are to remain in place. The Contractor shall not remove the above wall until after the lime feed equipment has been relocated.

In general, all salvageable building specialties, equipment and salvageable ferrous materials shall become the property of the Owner and shall be stored on the Owner's property by the Contractor, as directed by the Engineer.

The Contractor shall haul all unwanted materials, non-salvageable materials, trash and rubbish of all kinds from the site. All costs of disposal shall be included in the price bid.

1.12 Service: The Contractor shall furnish the services of competent factory representatives for the purpose of supervising and/or inspecting the installation and initial operation of all major items of material and equipment.

Periods of installation and initial operation shall occur on successive days, if possible. Periods of service on more than one item of equipment furnished by the same manufacturer may run concurrently, if possible, and when approved by the Engineer. Manufacturers furnishing supervisory and/or inspection services for any item of equipment shall extend such services to include all equipment furnished by said manufacturer.

1.13 Bids on Major Equipment: The Bidder is required to furnish the names of the manufacturers of major items of equipment in the spaces provided in the Proposal in accordance with the following:

(a) Major Equipment: The Bidder shall list at least three manufacturers of suppliers named in these Specifications for each major item of equipment in the Proposal and the bid price for the item. Unless otherwise specified, the lowest price shall be used in the base bid.

The equipment of manufacturers other than those named in these Specifications will be considered in accordance with the provisions of "Instructions to Bidders and Special Provisions" of these Specifications, if such equipment is offered by the Bidder under the heading, "Alternate Equipment" in the Proposal.

(b) Alternate Equipment: The Bidder offering alternate equipment shall include the name of the manufacturer of such equipment and the bid price for the item in the spaces provided in the Proposal under the heading, "Alternate Equipment". The bid price for the installation of alternate equipment shall include the cost of, and all costs incidental to, changes in structural, mechanical, electrical, and appurtenant work, which may be required for the accommodation of such alternate equipment; which changes shall be as determined by the Engineer.

(c) Preliminary Information Required: It shall be the responsibility of the Bidder to ascertain that each manufacturer named in his Proposal under the base bid or under the heading "Alternate Equipment" has submitted to the Engineer complete information on the equipment offered at least two weeks in advance of the letting date. The information submitted shall include complete drawings, specifications, and weights of principal parts and all additional information required for any specific item. Equipment which does not have a record of successful service for five years may be accepted at the discretion of and upon the terms and conditions set forth by the Engineer.

(d) Standardization of Equipment: In order to avoid a division of responsibility among several manufacturers for like items of equipment having functions relating to each other or to the same part of the treatment process, and to avoid unnecessary duplication of replacement parts, the individual categories below shall be the product of or guaranteed by one manufacturer.

(1) Butterfly Valves and Controls

(2) Filter Controls and Instrumentation

(3) Filter Bottoms

(4) Flocculator Equipment

(5) Collector Equipment

(6) Gate Valves and Controls

(7) Plug Valves and Controls

(8) Metering and Instrumentation

(9) Filter Sweeps

1.14 Instruction Manuals: Before equipment is placed in service, six sets of clean and unused instruction manuals shall be delivered by the Contractor to the Owner. Instruction manuals shall list all of the equipment specified in this and other referenced data; and shall show operating instructions; maintenance instructions; lubrication instructions; piping, wiring, and control diagrams; and assembly drawings showing locations of parts, part numbers, and spare parts list.

1.15 Materials to be Obtained from Equipment Manufacturers: The Contractor shall obtain from the manufacturer, all materials and/or components specified or required for the safe operation or use of each item of equipment, except that connecting piping and valves, railings set in tanks or structures, motor starters and wiring, finish painting, and other such work and materials may be obtained from other sources.

1.16 Information Required for Approval: Each manufacturer furnishing equipment shall submit the following information to the Engineer for approval:

(a) Drawings: Six (6) sets of certified drawings, guaranteed performance curves, wiring diagrams, and lists of electrical controls (including manufacturer's name, catalog number, horsepower of motors, normal full load, and maximum load ampere rating for each motor).

(b) Weight: Estimated weight of each unit of equipment.

(c) Spare Parts and Tools: Lists of spare parts and tools to be furnished with equipment. Unless otherwise specified, only special tools required for the particular equipment shall be furnished with equipment.

(d) Installation and Operating Instructions: After approval of equipment has been given, the manufacturer shall furnish six (6) sets of complete installation, operating, and maintenance instructions.

1.17 Mechanical Tests: After installation of each unit of mechanical equipment, the unit shall be operated continuously for a period of twenty-four (24) hours. During this period, the equipment will be inspected for defects and weaknesses; parts of the units showing a defect and weakness shall at once be

replaced, or shall be made good in a satisfactory manner at no additional expense to the Owner. After parts of the equipment showing defects and weaknesses have been replaced or made good, additional mechanical tests shall be made with the equipment operating continuously for a twenty-four (24) hour period until no further defects and weaknesses occur in the unit. After installation and final testing of equipment, each manufacturer furnishing supervision and/or inspection services shall make written certification to the Engineer and the Owner that his equipment, and the controls therefor, have been properly installed in accordance with the Specifications and Drawings, and that the operating and maintenance instructions have been furnished to the Owner.

1.18 Patents: The Bidder shall guarantee to the Owner that all equipment offered under these Specifications, or that any process resulting from the use of such equipment in the manner stated, is not the subject of patent litigation, and that he is not knowingly offered equipment, the installation or use of which is likely to result in a patent controversy, in which the Owner as user is likely to be made the defendant.

(a) License: Where patent infringements are likely to occur, each bidder shall submit, as a part of his bid, license arrangements between himself, or the manufacturer of the equipment offered, and the patent Owner or the controller of the patent, which will permit the use, in the specified manner, of such mechanical equipment as he may be bidding upon.

(b) Liability: Each bidder, by submitting his bid, agrees to hold and save the Owner, its officers, agents, and employees harmless from liability of any nature or kind, including cost and expenses, for, or on account of, any patented or unpatented invention, process, article or appliance manufactured or used in the performance of the work under this Contract, including the use of the same by the Owner.

1.19 Piping and Appurtenances for Mechanical Equipment: The Contractor shall furnish completely dimensioned layouts for all piping, fittings, valves, specialties and equipment and appurtenances thereto. Openings in floors, walls, and other parts of buildings and structures shall be accurately made from said layouts. All piping and appurtenances shall be properly supported and blocked from movement by a system of hangers, pipe stands, base ells, and concrete piers, as required. Concrete inserts, bolts, anchors, and any other such work shall be properly set in form work before concrete is poured.

1.20 Electrical Equipment: Electrical equipment furnished for operating mechanical equipment shall, in general, be in accordance with the following:

(a) Motors: All electric motors shall be of General Electric, Allis-Chalmers, Westinghouse, or other approved manufacture; windings shall be impregnated with moisture-proof insulating compound. Outdoor horizontal motors shall be totally enclosed, weatherproof; vertical motors shall be splash and dripproof. All single and three-phase motors, except for fan motors which may be of an approved manufacturer's standard, shall be ball-bearing, with either sealed-in lubricant, or designed for external oil or grease lubrication.

(b) Voltage: Electrical motors larger than 1/2 HP shall be 208-460 volt, 3 phase, 60 Hertz induction type, and have full voltage starting, unless designated otherwise. Motors smaller than 1/2 HP, unless otherwise specified, shall be single phase and designed for 120 volt, 60 Hertz operation.

Motors 1/4 HP and larger shall be capacitor type; smaller motors may be of capacitor or shaded pole type.

(c) Control Equipment: In general, electrical control equipment shall be furnished in accordance with the "Electrical Work" section. The manufacturer of mechanical equipment shall furnish only those items of electrical equipment which are required under the section which specified his equipment.

1.21 Electrical Standards and Codes: Electrical equipment, devices, and materials shall be subject to the requirements of the Fire Underwriters' Association, and the National Electric Code, and shall have the name or trademark of the manufacturer and the rating in volts and amperes, or other units, marked where they may be readily observed after installation.

1.22 Small Piping and Electrical Wiring for Instrumentation, Controls, and Mechanical Equipment: All small water supply piping, control piping, drain piping, pneumatic piping, electrical controls, electrical wiring, and miscellaneous controls may not be shown and/or completely detailed on the Drawings for every item of instrumentation, control, and mechanical equipment; however, it shall be the responsibility of the Contractor to furnish and install all such items of work necessary for a first class, complete, and workable system. All equipment, in general, shall be furnished with drip lip type base; with drains connected into the nearest drain system so that no piping will run across the floors and no water, oil, and other waste will drip on the floors.

1.23 Painting: All painting of materials and equipment shall be applied by approved applicators, and be as specified under the "Painting" section. All shop painting shall be applied under the direct supervision of the supplier of the painting materials.

1.24 Project Sign: Immediately upon commencing work, the Contractor shall furnish and erect one (1) special Water Works project sign at the location to be determined in the field by the Engineer. The sign shall be not less than 8 feet high x 10 feet long, constructed upon sturdy wood frame having 3/4" plywood face with wood ogee molding. The sign shall be erected to stand upon 6" x 6" posts, embedded at least 3 feet in the ground in concrete backfill. The entire sign, frame, and face shall have white lead and oil prime coat followed by two finish coats of the same. The sign shall be lettered by a professional sign painter; to show project designation, names of City Officials, Engineers and Contractors, and including certain project description, lettering, and arrangement to be furnished by the Engineer. Details of the sign must be approved by the Engineer.

1.25 Guarantee: The Contractor, the equipment manufacturer, and the supplier shall guarantee all mechanical equipment to be free from defects in workmanship, design, and material for a period of one (1) year after final acceptance of the work, and shall replace without charge those parts of the equipment which are defective or showing undue wear within the guarantee period.

1.26 Cleaning Up: Upon completion of the work, all excess material and rubbish shall be removed from the site of the work, and be disposed of by the Contractor at his expense. The surrounding construction area shall be left in essentially as good a condition as existed before the work was done.

1.27 Sterilization: Upon completion of all work, the Contractor shall sterilize the additions to the Water Treatment Plant. The Contractor shall furnish all sodium hypochlorite and provide all equipment and labor necessary for sterilizing in accordance with the following and as directed by the Engineer.

(a) Filters: Sodium hypochlorite shall be applied to the filters by introducing the solution at the influent from the settling basins. Care shall be taken that sodium hypochlorite concentration is present throughout the flumes, beds and manifolds, and piping systems; introducing of sodium hypochlorite solution into the filters shall continue until the indicated sodium hypochlorite residual concentration in the filter units is maintained at 25 parts per million for 12 hours exposure.

(b) Piping: All pipe lines and appurtenances, both existing and new carrying filtered water which have been exposed to contamination by reason of this construction shall be sterilized. Sodium hypochlorite solution shall be introduced into the piping system as the systems are slowly filled. The introducing of sodium hypochlorite shall continue until the indicated sodium hypochlorite residual concentration in the systems is maintained at 25 parts per million for 12 hours exposure.

(c) Post Flash Mixer: Sodium hypochlorite shall be applied to the post flash mixer by introducing the solution to the influent pipe line to the post flash mixer. Introducing sodium hypochlorite solution into the post flash mixer shall continue until the indicated residual concentration of sodium hypochlorite in the post flash mixer is maintained at 25 parts per million for 12 hours exposure.

1.28 Payment: No separate payment will be made for work under this Section of Specifications. The cost of all such work and all costs incidental thereto shall be included in the amount bid for the item to which the work pertains.

SECTION NO. 2

CONTROL OF MATERIALS

2.01 Source of Supply and Quality of Materials: The source of supply for all materials and equipment shall be submitted to the Engineer for approval before orders are placed. Suppliers of reinforcing steel, fabricated metal work, and metal castings may be required to submit guarantees of conformity with the Drawings and Specifications. Representative preliminary samples of the character and quantity prescribed shall be submitted by the Contractor for examination, and be tested in accord with the methods referred to under Samples and Tests. Only materials conforming to the requirements of the Specifications and approved by the Engineer shall be used in the work. All materials proposed to be used may be inspected or tested at any time during their preparation and use. If, after trial, it is found that sources of supply which have been approved do not furnish a uniform product, or if the product from any source proves unacceptable at any time, the Contractor shall furnish material from other approved sources. No material, which after approval has in any way become unfit for use, shall be used in the work.

2.02 Samples and the Testing of Materials: Unless otherwise provided, tests of materials shall be made in accord with the Specifications and Tests of the American Society for Testing and Materials, by a commercial testing laboratory approved by the Engineer. Test reports shall promptly be furnished to the Engineer. Tests will be arranged for by the Contractor, unless otherwise directed by the Engineer. The cost of all laboratory tests shall be paid by the Contractor.

2.03 Schedule of Materials and Standard Tests: The following schedule of materials and the standard tests to which each is to be subjected are given for the Contractor's guidance.

CEMENT:

(a) Less than carload lots - The brand of a mill in successful operation for at least one year.

(b) 1 car to 5 cars - Certificate of mill test to be furnished by producers of laboratory tests made as per ASTM C150-74, or Fed. Spec. SS-C-158.

SAND: For use in Cement Concrete:

(a) 10 tons to 100 tons - Field tests only:

(1) Color for organic matter
(2) Decantation test for silt
(3) Sieve analysis

(b) For each additional 100 tons - Independent Laboratory tests to indicate conformity with ASTM C33-74a, as amended to date, or Fed Spec. SS-A-281b.

STONE AND GRAVEL: For use in Cement Concrete: (Coarse Aggregate)

(a) 10 tons - 200 tons - Similar to Sand (a)

(b) Each additional 200 tons - Similar to Sand (b)

CONCRETE:

Preliminary Tests	Job Tests
Cylinder Compression Tests of concrete made of cement and aggregate proposed to be used in the work; in accord with ASTM C39-72.	Cylinder Compression Tests of Concrete placed in the work, from samples taken at two different times during any major pour of Structural Concrete; in accord with ASTM C39-72.

Preliminary tests shall include at least two cylinders; one to be broken at 7 days and one at 28 days.

Job tests shall include at least four cylinders for each test; two to be properly stored at the site; and two for laboratory control, one each to be broken at 7 days and one each at 28 days.

BRICK (Building):

(a) 1 to 5 thousand - Visual inspection for shape, color, soundness, freedom from cracks, balls of clay or particles of lime.

(b) For each additional 50 thousand or part thereof - Absorption test and either compression or flexure tests in accord with ASTM C67-73 by an independent laboratory.

CONCRETE MASONRY UNITS:

(a) 1 to 5 thousand - Visual inspection for soundness, freedom from cracks and chips, or other defects.

(b) For each additional 10 thousand or part thereof - In accord with ASTM C140-75.

BUILDING STONE:

(a) 1 to 5 tons - Visual inspection for shape and color.

(b) For each additional 5 tons or part thereof - Same as (a); also, tests for absorption and compression as per ASTM C97-47 (1970), and C170-50 (1970).

STRUCTURAL STEEL:

(a) Any quantity - Field inspection for rust, shape, and dimensions.

(b) 25 to 200 tons - Independent shop inspection and certified copies of mill tests.

(c) For Bridges and Buildings - See ASTM A283-75.

CONCRETE REINFORCING STEEL:

(a) Up to 50 thousand lbs. - Field inspection for rust, shape, and dimensions.

(b) 50 thousand lbs. and up - Independent laboratory inspection as follows:

(1) Billet Steel - ASTM A615-75

(2) Rail Steel - ASTM A616-75

(3) Cold-Drawn Steel Wire - ASTM A82-72

(4) Wire Fabric - ASTM A185-73

VITRIFIED CLAY SEWER PIPE:

Field Inspection: For shape, cracks, blisters, absence of vitrification, hammer test, laboratory stamp.

Laboratory Tests: In amount and character as per ASTM C700-74, C301-72, and C425-74.

Each length of pipe shall be inspected and stamped by a regular employee of the approved testing laboratory.

PERFORATED CLAY PIPE:

Field Inspection: For shape, cracks, blisters, glaze, perforations, laboratory stamp.

Laboratory Tests: In amounts and character as per ASTM C700-74.

NON-REINFORCED CONCRETE PIPE:

Field Inspection: For shape, cracks, uniformity, density, imperfect surfaces, hammer test, permeability test, damaged ends and gasket grooves, laboratory stamp.

Laboratory Tests: In amount and character as per ASTM C14-74.

Each length of pipe shall be inspected and stamped by a regular employee of the approved testing laboratory.

REINFORCED CONCRETE PIPE:

Field Inspection: For shape, cracks, uniformity, density, imperfect surfaces, damaged gasket grooves, laboratory stamp.

Laboratory Tests: In amount and character as per ASTM C76-74.

Each length of pipe shall be inspected and stamped by a regular employee of the approved testing laboratory.

CAST IRON PIPE AND DUCTILE CAST IRON PIPE:

Field Inspection: For dimensions, coating, cement lining, holes, hammer test, weights.

Laboratory Tests: Certified test reports by foundry.

STEEL PIPE:

- ASTM A134-74, and A139-74.

MANHOLE BRICK:

Visual inspection for size, shape, soundness, balls of clay, or particles of lime.

CAST IRON CASTINGS:

Field Inspection: For dimensions, coating, holes, hammer test.

Laboratory Tests: Certified test reports by foundry.

2.04 Payment: No separate payment will be made for work under this Section of the Specifications. The cost of such work and all costs incidental thereto shall be included in the price bid for the item to which the work pertains.

SECTION NO. 3

SITE WORK

3.01 Scope: The work described by this Section consists of furnishing all materials and equipment, and performing all labor, necessary for clearing, excavating, backfilling, grading, and grassing for site development and construction of the structures shown. All work shall be done in strict conformity with the Specifications and the directions of the Engineer.

3.02 Site Conditions: The Contractor's attention is directed to paragraphs of the "Instructions to Bidders and Special Provisions" relating to Site Examination.

3.03 Clearing Site: The site shall be cleared of all obstructions interfering with the construction of new work. The area shall be cleared of trees, stumps, roots, brush, rubbish, and other such materials to at least 10 feet beyond new fence line. Trees and shrubs designated to be left in place, and those outside of construction limits, shall not be damaged. Clearing shall be coordinated with the City prior to beginning construction in order to save trees and vegetation considered desirable by the City.

(a) All materials resulting from clearing operations shall be disposed of in accord with the Rules and Regulations of both the Air Quality Control Section and the Solid Waste Management Section of the Environmental Protection Division of The Georgia Department of Natural Resources.

(b) All structures, pavements, fences, or other such facilities which are removed or damaged by construction operations, but not in the way of new work, shall be replaced as required at Contractor's expense.

3.04 Stripping: The Contractor shall strip the entire area within cut, fill and graded areas to remove all top soil, vegetable matter, stumps, roots, and other objectional materials. Top soil and vegetable matter shall be carefully stockpiled and preserved for surfacing fill slopes. Roots and stumps shall be grubbed out and removed from the property. The base of all embankments and fills shall be scarified and rolled so that the base will be well bonded with the first layers of fill.

3.05 Grading: Before the beginning of construction operations, the area upon which the structures and buildings are to be located shall be graded to conform, in general, with finish elevations shown on the Drawings.

(a) Additional Material: If additional suitable material, other than that to be obtained from excavation, is required for backfilling and grading, the Contractor shall locate and obtain such additional suitable material. No separate payment will be made for the procurement of such material; all costs shall be included in the items to which the work pertains.

(b) Excess Material: All excess earth excavation, and all rock excavation shall be placed on or near the site as directed by the Engineer. Surfaces and slopes of waste fills shall be left smooth and free to drain.

3.06 Excavations: The Contractor shall perform all excavating of every description, and of whatever substances encountered, to the dimensions and levels shown on the Drawings, and/or specified. Excavation may be accomplished by any customary method.

(a) Rock: Rock will be unclassified as such for additional payment. The bidder shall satisfy himself as to rock and other materials which may be encountered in excavation, and make proper allowances for all contingencies in his lump sum bid. Any information indicated on the Drawings, or otherwise furnished, with reference to drillings made on the plant site are offered as information only. The Engineer has sufficient knowledge of sub-surface conditions to enable him to design the structures and foundation. This information is too meager to be used for calculation of volume of rock excavation with sufficient accuracy. The bidder must therefore rely on his own information and is invited to make his own borings and to form his own opinion of the character of the sub-surface conditions. Some rock excavation was necessary to construct the previous project.

(b) Footings: Footings shall be excavated to the depth indicated on the Drawings, or beyond, to firm undisturbed earth for proper bearings.

(c) Method: Excavation may be accomplished by any customary method. If blasting is found to be necessary, the Engineer shall be advised before any explosive is brought on the job and he shall prescribe such precautionary measures as he deems necessary.

(d) Limits: Excavate for sufficient distance from foundation walls to allow for inspection and to permit the various trades to install their work. Trenches for foundation walls shall be a minimum of two feet wider than the thickness of the walls. Excavation for piers shall be at least two feet greater than the dimensions of the footings. Excavation for footings shall be to the footing dimensions.

(e) Depth: Care shall be taken that excavation does not extend below the exact lines of the footings and floor slabs on ground, unless otherwise authorized. Should the excavation, through carelessness or negligence on the part of the Contractor be carried below such lines, the Contractor shall fill in the resulting excess excavation with concrete under walls and footings and with concrete or crushed stone, as directed, under slabs. This work shall be done at the Contractor's expense. Concrete for this purpose shall be of the same quality and mix as that for footings.

(f) Slabs on Earth: Where slabs on earth occur, all loam, organic, or other undesirable material shall be removed as required by the Engineer. When filling is required to bring such excavated area to the levels required to receive slabs, the fill shall be compacted by tamping and rolling to obtain 95% of maximum density. Layers shall be not more than six (6") inches thick. Fills shall be constructed in accord with roadway specifications herein.

(g) Slabs on Rock: Where slabs or footings on rock occur, the rock shall be excavated a minimum of 6-inches below the slab and backfilled to grade with 1-1/2-inch maximum size crusher run stone compacted by an approved 15 ton vibratory compactor.

3.07 Blasting: All blasting for rock excavation shall be done under the supervision of a Blasting Engineer retained and employed by the Owner. It will be his duty to advise the blaster of hole spacing and loading and to make seismic and concussion measurements where deemed necessary. The Contractor shall cooperate with the Blasting Engineer by uncovering and exposing pipe and structures for instrument mounting. He shall also advise the Resident Engineer when each shot is ready so that measurements may be taken if needed.

Blasting operations shall be conducted in strict accordance with all existing ordinances and regulations and shall be done only with the Blasting Engineer's approval and under his supervision.

All exposed structures shall be carefully protected from the effects of the blasts and all blasts shall be covered with blasting mats, dirt, heavy timbers or other suitable material. The blasting shall be done by experienced workmen. Any damage done shall be promptly repaired by the Contractor at his own expense. All blasting supplies shall be stored in a manner approved by the State Fire Marshal, and a watchman shall be stationed at all times at the place of storage.

All shots shall be delayed so as to minimize ground vibrations with a maximum peak particle velocity, as measured at the nearest structure (pipes, etc.) not to exceed 2.0 inches per second. The overpressure (noise or concussion) shall be minimized and sufficient stemming and matting used to prevent overpressure in excess of 120 db. Precautions shall be taken to minimize flying rock and sufficient matting used to prevent rocks from striking any person or structure.

Vibration recording instruments shall be used on the initial shots, and all others deemed necessary to determine proper blasting procedures. These instruments shall be of the type which records on direct-reading tape the three (3) components of velocity. The analysis of these recordings are to be signed by a Registered Professional Engineer in Georgia. Blasting is not to be conducted which will produce a Scaled-Distance less than previously recorded for at least three (3) different shots deemed to be safe. The Scaled-Distance is to be determined by the distance from the shot to the nearest structure subject to potential damage from ground vibrations.

Overpressure (concussion) is to be recorded on direct-recording tape, preferably on the same recording as the vibration. The instrument used for measuring concussion shall be the type specifically designed for impact-type overpressure from blasting.

The blaster is to maintain an accurate log of each shot, listing as a minimum the following: date, time, station number, manufacturer and type of explosive, method of firing, total weight of explosive, number of delays, number of holes, hole depth, maximum weight of explosive per delay, amount of stemming, type and amount of matting.

3.08 Dewatering: The Contractor shall use well points, pumps, or other approved methods to prevent the accumulation of water in excavated areas. The Contractor shall also provide for dewatering areas adjacent to uncompleted structures to prevent uplift during construction operations. The Contractor will be held responsible for any damage to uplift of such structures during construction operations.

3.09 Yard Fills and Backfilling Around Structures: All yard fills and backfills around structures shall be of selected materials properly placed in layers. The layers shall be thoroughly compacted to at least 95% of maximum density, each layer to be not deeper than six (6") inches compacted thickness. Compaction of yard fills shall be by use of heavy sheeps foot roller and until the roller "walks out". Compaction around structures shall be by use of heavy power tamping equipment. Selected materials shall also be used for backfill around pipe in pipe trenches. Fills shall be constructed in accordance with roadway specifications herein.

3.10 Finish Grading: Finish grading shall be performed in accordance with the finished elevations and grades shown on the Drawings and shall be made to blend into conformation with remaining natural ground surfaces. All finished grading surfaces shall be left smooth and free to drain. The tops of all cuts shall have berm ditches. Selected materials, which have been obtained from stripping the site, shall be spread upon the slopes of fills and other areas to be grassed to a uniform depth and compacted suitably for planting. The spreading of selected materials shall not be done until the work of planting is ready to proceed. Excess materials shall be spread and compacted as directed.

3.11 Grassing shall be with Bermuda seed and live Bermuda sprigs or, if ordered by the Owner, with Domestic Italian Rye seed.

(a) Grassing with Bermuda shall be done only if it can be completed between May 15 and August 15. Grassing after the above 3-month period and before November 15 shall be done with Domestic Rye at the Owner's option. The work of grassing shall include all fill slopes within the fenced area.

(b) Bermuda sprigs shall be live, fresh and selected with roots uninjured from sources native to the locality of the work as approved by the Engineer. Sprigs shall be planted in furrows ten inches apart, the furrows to run parallel to contours of the same approximate elevation, sprigs to be eight inches apart in the furrow.

(c) Before planting, a fertilizer of 4:12:4 or other approved composition shall be hand raked into the top soil at a rate of 25 pounds per 1,000 square feet and then watered. All sprigs shall be placed within an hour after removal from the location in which they are growing. Ground shall be damp or freshly watered before planting. Sprigs shall be rolled after planting. Hulled Bermuda seed shall be tamped in on all areas planted with sprigs at the rate of 3 pounds of seed per 1,000 square feet of surface area.

(d) All planting and seeding shall be watered thoroughly as soon as completed and shall be watered at least twice daily, or oftener if necessary to provide continuous growth without setback until all growth from seed is thoroughly established.

(e) Domestic (Italian) Rye seed, if used, shall be raked in at a rate of 10 pounds per 1,000 square feet. Fertilizer and watering shall be the same as for Bermuda.

(f) If the schedule of construction is such that grassing cannot be accomplished before final inspection of all other items in the plant, the Contractor shall obtain a signed proposal to the Owner from an

approved local landscaper for the work specified. The Owner shall deduct the amount of the proposal from the final payment. The work of spreading and compacting top soil shall be performed, as specified in the FINISH GRADING article, by the local landscaper at time of grassing and this work shall be included in his proposal.

(g) In general, the areas to be grassed shall include all areas bounded by cut and fill slopes. All slopes shall be grassed, and all other graded areas, whether cut or fill, shall be grassed as indicated on the Drawings. Existing grass damaged by construction work shall be repaired or replaced, as directed by the Engineer.

3.12 Roadway and Yard Paving: The Contractor shall replace existing pavement removed or damaged as a result of work performed under this Contract, as well as provide materials as necessary for paving the new roadways and yards. Where pavement is removed for installation of pipe lines and conduits crossing roadways, backfill shall be completed to within 10 inches of the surfaces of the existing paving. The Contractor shall then cut back such additional paving as necessary to provide not less than 9 inches bearing in undisturbed earth soil and pour 9 inches of concrete to within one inch of the existing paved surfaces. After installing the concrete base, the Contractor shall remove a sufficient amount of the adjacent paving, for at least one inch in depth to provide for the edges of the patched areas to be perpendicular to the centerline of the roadway. After the concrete has cured and the area to be patched is trued-up, the Contractor shall thoroughly clean the areas, coat all edges of existing paving, and provide a one inch thick wearing surface over the entire area to be patched. Replacement of paving through paved yards shall be made in a manner similar to that specified above. Where pavement is removed for installation of pipe lines or conduits installed in roadways parallel or near parallel to the centerline of the roadways, the Contractor shall provide the nine inches deep concrete subbase over the trench, shall remove one inch of the existing paving surface between curbs, and provide a one inch thick wearing surface over the entire existing roadway area or, where the roadway does not have curbs, the one inch thick wearing surface may be installed over the surface of the existing paving. Where more than one-half of the existing paved area is removed, the Contractor shall remove the entire paved area and install new base and surface course as specified below. Materials for base course and surface course shall be as follows:

(a) Roadway Surfacing: Areas shown to be paved shall have an 8-inch compacted graded aggregate base course, bituminous tack coat, and one and one half inch plant mix surface course. Materials and construction methods shall conform to the "Standard Specifications for Highway Construction" of the Georgia Department of Transportation, dated April 20, 1972, as amended to date, as follows:

Section 300: Specifications Applying to All Base and Subbase Courses.

Section 310: Graded Aggregate Construction.

Section 413: Bituminous Tack Coat.

Section 400: Hot Mixed Asphalt Construction.

3.13 Walks: Walks shall be constructed of 4" Class B concrete.

3.14 Fencing: Relocate the existing fence where shown, and provide new fencing where shown. The fence shall be of the height shown, and consist of 2" mesh x 9 gauge galvanized-after-weaving fabric and, for the relocated fence, 3-strand barbed wire, galvanized, pressed steel post tops, 2-1/2" O.D. (3.652 lbs. per ft.) galvanized line posts, 3" O.D. (5.79 lbs. per ft.) galvanized end and corner posts, 4" O.D. (9.109 lbs. per ft.) gate posts, and 1-5/8" O.D. (2.272 lbs. per ft.) galvanized top rail with extra-strut and tie bracing. Set posts for relocated fence on not more than 10-foot centers, fully 3 feet deep in concrete footings placed the full size of holes as excavated.

3.15 Payment: Payment for all earth work shall be included in the lump sum price stated in the Proposal. Payment for Rye grassing and for Bermuda grassing shall be included in the lump sum bid price. The Bidder shall list under "Deductions" in the Proposal, the amount to be deducted for the elimination of Rye grassing at the Owner's option.

SECTION NO. 4

CONCRETE WORK

4.01 Scope: The work described by this Section consists of furnishing all materials and equipment, and performing all labor necessary for the complete construction of all concrete work, including all work and appurtenances thereto, as shown or specified, or both. Work shall include the installation of all sleeves, inserts, piping, hangers, anchors, frames, and other items to be built into the concrete work, and all other work and appurtenances specified or required, or both, for proper execution of the work. All items shall be correctly positioned in form work, and must be inspected and approved by the Engineer before concrete is placed.

4.02 Concrete: Concrete shall be composed of cement, fly ash (if required), admixtures (if required), fine aggregate, coarse aggregate, and water proportioned and mixed to produce a plastic workable mix in accord with the requirements of this Section, and shall be suitable for the specific conditions of placement. Concrete shall be classified as "A", "B", and "C"; shall have normal setting characteristics (unless the use of high early strength cement is approved by the Engineer); shall be used in the locations identified below; and shall have 28-day compressive strengths not less than those listed below, except that concrete containing high early strength cement shall have 7-day compressive strengths not less than those listed below.

(a) Class "A" concrete shall have a compressive strength of not less than 3,000 psi, and shall be used for reinforced concrete work, and for unreinforced footings and slabs not thicker than 8-inches.

(b) Class "B" concrete shall have a compressive strength of not less than 2,200 psi, and shall be used for gravity type walls, and for unreinforced footings and slabs thicker than 8-inches.

(c) Class "C" concrete shall have a compressive strength of not less than 1,500 psi, and shall be used for concrete subfoundations, pipe envelopes, and concrete backfill where required.

4.03 Materials:

(a) Admixture shall be added to Class "A" and Class "B" concrete. The admixture shall be Master Builders' "Pozzolith", or approved equivalent, and shall be added in accord with the admixture manufacturer's printed instructions. A standard dispenser shall be used to introduce the admixture into the mix, and the services of the admixture manufacturer's representative to install and establish the operation of the dispenser shall be furnished by the Contractor.

(b) Fine aggregate shall be natural sand consisting of hard, strong, durable, and uncoated particles having fineness modulus of not less than 2.30 nor more than 3.00; variation in fineness modulus shall be limited to +0.20 from the average of all tests. Aggregate shall satisfy the requirements of Federal Specifications SS-A-281b, Class 1, Grade A, or ASTM C33-74a, and have gradation as follows:

Sieve Size	Per Cent Passing, by Weight
No. 4 Sieve	95 to 100
No. 16 Sieve	50 to 85
No. 50 Sieve	10 to 30
No. 100 Sieve	2 to 10

(c) Coarse aggregate shall be washed gravel or crushed stone consisting of hard, strong, durable, and uncoated particles; and shall contain neither vegetable matter nor soft, friable, thin, and elongated particles in quantities considered deleterious by the Engineer. Coarse aggregate shall satisfy the requirements of Federal Specifications SS-A-281b, Class 2, Grade A, or ASTM C33-74a; and have gradation as follows:

Sieve Size	Per Cent Passing, by Weight
1-1/2" Sieve	100
1" Sieve	95 to 100
1/2" Sieve	55 to 30
No. 4 Sieve	5 to 0
No. 16 Sieve	1 to 0

(d) Cement shall satisfy the requirements of ASTM C150-74; cement for normal Class "A", "B", and "C" concrete shall be Type I or II; cement for high early strength Class "A", "B", and "C" concrete shall be Type III. Type III cement shall be used only if its use is approved by the Engineer.

(e) Fly ash, if used, shall satisfy the requirements of ASTM C618-73, except that the loss-on-ignition shall be not more than 6%.

(f) Forms shall be of plywood or of tongue-and-groove lumber, and shall be of grade and type suitable to obtain the finish required. Forms constructed of tongue-and-groove lumber shall be lined when used for exposed surfaces. Form lining, where used, shall be of tempered fiber board of not less than 1/8-inch thickness. Metal forms, and other types of manufactured forms, shall not be used unless their use has been authorized by the Engineer. Form ties shall be of the cone nut threaded rod, or standard snap-tie type, and designed so that when removed no metal will be left closer than 1-inch from the finished wall face. The cavities left in faces of concrete work by removal of form ties shall be pointed-up with non-staining, non-shrink mortar. Form ties shall have a working strength of not less than 3,000 lbs. when fully assembled, and shall be as approved by the Engineer.

(g) Form bond breaking coatings shall be as follows:

(1) Initial Treatment: Apply two (2) coats of mixture consisting of one (1) part Form-Lac and one (1) part Form-Lac Thinner. During application, keep mixture thinned to original viscosity by adding more Form Lac Thinner as required to compensate for evaporation. In addition to main surfaces, also coat all edges of perimeter, cutouts, tie holes, etc.

(2) Additional Treatments: Before initial use of forms, and before each re-use, apply one (1) coat of Symons Magic Kote.

(h) Water shall be fresh, clean, and free from injurious amounts of oil, acid, alkali, and organic materials.

(i) Floor hardener shall be silicious aggregate: Master Builders' "Mastercron Aggregate", or Devoe Paint Division of Celanese Coatings Company's "Hurundum".

(j) Water stops shall be of those configurations and type shown.

(k) Grout for bonding new concrete to existing concrete shall be composed of 1 part Portland cement to 3 parts sand to those parts of water which will produce a grout having a consistency approved by the Engineer.

(l) Roof Topping shall be composed of 1 part Portland cement to 1 part of sand to 2 parts of aggregate not larger than 3/8", and to those parts of water which will produce a topping having a consistency approved by the Engineer.

(m) Expansion joint filler and sealer shall be as shown.

4.04 Storage:

(a) Cement and fly ash shall be stored immediately upon receipt at the jobsite, and in a thoroughly dry, weather-tight, and properly ventilated building having adequate provisions for preventing cement from absorbing moisture. Storage shall permit ease of access for inspection, and permit definite identification of each shipment.

(b) Fine and coarse aggregate shall be stored separately, and in a manner which will avoid the inclusion of foreign material. Stockpiles of coarse aggregate shall be built in horizontal layers, and in a manner which will minimize or eliminate segregation.

4.05 Sampling and Testing of aggregate, cement, and concrete cylinders shall be as specified in the "Control of Materials" section, and in accord with the following:

(a) The Contractor shall select the source of the concrete aggregates which he proposes to use in the work, and shall furnish suitable samples of those aggregates to the testing laboratory for testing and preparation of design mix, at least 30 days in advance of the time of proposed use.

(b) Cement which has been stored for more than four months after being tested shall be re-tested before use.

(c) Concrete cylinder for testing purposes shall be made in accord with the procedure described in ASTM C31-69. Compression tests shall be made at the age of 7 days and 28 days by the testing laboratory in accord with the procedure described in ASTM C39-72, and as required by the Engineer. After beginning work, the number of tests shall be as listed in the following table, but shall be not less than one for each type of concrete for each pour. Each test shall consist of at least 4 specimens; two (2) shall be field control and two (2) for laboratory control.

Total Cu. Yds. Concrete Placed	Minimum Number Tests
0 to 100	One each pour
100 to 1,000	One each 250 Cu. Yds.
1,100 to 2,000	One each 350 Cu. Yds.
2,000 and Over	One each 500 Cu. Yds.

(d) Slump tests of concrete shall be made in the field by the Contractor for each pour with an accurately made sheet iron test cone, and in accord with the procedure described in ASTM C143-74. The slump of concrete shall be not less than 3-1/2 inches, nor more than 5-1/2 inches.

4.06 Design Mix for each classification of concrete to be used in the work shall be prepared and tested by the independent, commercial, testing laboratory selected by the Contractor and approved by the Engineer for the testing of materials. The design mix shall be prepared using samples of the cement, fly ash (if required), admixture (if required), and the aggregates to be used in the work. Not fewer than four (4) cylinders shall be made from the design mix for each classification of concrete; two (2) shall be tested at 7 days, and two (2) shall be tested at 28 days. Cylinders shall be made and tested in accord with ASTM C31-69, and C39-72.

4.07 Proportioning of material shall be accomplished in a manner which will produce a workable mixture having a slump within the required limits, and having minimum water content.

(a) The exact proportion of materials to be used in concrete shall be as determined by the Laboratory Design Mix, and as directed by the Engineer. The equipment necessary to positively determine and control actual amounts of materials entering into the concrete shall be furnished by the Contractor. The proportions of materials used in the mix shall be changed whenever, in the opinion of the Engineer, a change is necessary to obtain the required strength, and the desired density for uniformity and workability. In structures intended to be watertight, good workability will be considered to be of primary importance.

(b) All materials shall be measured by weight, except for water, which may be measured by volume. One (1) bag of Portland cement shall be considered to weigh 94 lbs., and one (1) gallon of water to weigh 8.33 lbs.

(c) Cement and Fly Ash Content: Concrete may contain fly ash as a substitute for cement in the following quantities:

(1) Each cubic yard of concrete containing Type I or Type III cement shall contain not less than the following quantities of cement and fly ash:

Class "A" --- 564 lbs. (6 bags) of cement or
470 lbs. (5 bags) of cement and 100 lbs. of fly ash
Class "B" --- 470 lbs. (5 bags) of cement or
376 lbs. (4 bags) of cement and 100 lbs. of fly ash
Class "C" --- 376 lbs. (4 bags) of cement; no fly ash required

(2) Each cubic yard of concrete containing Type II cement shall contain not less than the following quantities of cement:

Class "A" --- 564 lbs. (6 bags)
Class "B" --- 470 lbs. (5 bags)
Class "C" --- 376 lbs. (4 bags)

(d) In calculating the total water content of mixes, the amount of water borne on the surfaces of the aggregate particles shall be included. The amount of water to be used in the mix shall, in all cases, be the least amount necessary to produce a plastic mix having the required strength and the desired density, uniformity, workability, and characteristics within the required slump limits.

(e) The total volume of aggregates to be used in each cubic yard of concrete, and the proportion of fine aggregate to coarse aggregate, shall be that necessary to produce a dense mixture having the required workability, as determined by the Laboratory Design Mix, and as directed by the Engineer.

4.08 Mixing. Concrete may be proportioned and mixed by the Contractor on the jobsite, or may be proportioned and mixed at a central mix plant.

(a) When concrete is proportioned and mixed at the jobsite, the Contractor shall provide the equipment necessary to positively determine and control the actual amounts of materials entering into the mix. Mixing shall be done in a batch mixer of approved design, and shall ensure a uniform distribution of the material throughout the mass. The entire contents of the drum shall be discharged before recharging. The volume of the mixed material, per batch, shall not exceed the rated capacity of the machine. The Contractor shall, during the mixing and placing of concrete, have not fewer than two concrete mixers on the site so as to maintain continuity of the placing in the event of mechanical failure of one of the mixers. The mixing of each batch shall continue not less than 1-1/2 minutes after all materials are in the mixer, during which time the mixer shall rotate at a peripheral speed of not fewer than 200 feet per minute.

(b) When concrete is proportioned and mixed at a central plant, plant layout and equipment shall be subject to approval by the Engineer. Concrete shall be proportioned, mixed, and transported under the following conditions:

(1) The Contractor shall furnish the services of a representative of an approved testing laboratory, who shall be present at the central mix plant when Class "A" concrete is proportioned and mixed for the work, and shall control proportioning and mixing operations, except when otherwise approved by the Engineer.

(2) Loading tickets shall be initialed by the laboratory representative, and the time of loading stamped thereon. Tickets shall be handed to the inspector upon arrival of the mixer trucks at the jobsite, and before placing the load.

(3) Concrete shall be transported to the jobsite in approved mixer trucks, which will mix the concrete en route.

(4) The mixing and handling of ready-mix concrete, except as otherwise specified above, shall satisfy the requirements of ASTM C94-74a. In the event the above conditions are not satisfied, the concrete will be subject to rejection.

4.09 Placing: Before concrete is placed, the depth and character of the foundations, the adequacy of forms and falsework, and the placing of steel and appurtenant work shall be inspected, and must be approved by the Engineer; that approval, however, shall not relieve the Contractor from the responsibility to produce the finished work. Handling and placing of concrete, and the preparation for placing concrete shall be as follows:

(a) Accumulated water and debris shall be removed from excavations; and from form work into which concrete is to be placed; flow of water into those places shall be diverted into side drains or sumps, and be removed without disturbing newly-placed concrete. Forms, unless lined, shall be thoroughly wetted with water before concrete is placed so as to tighten joints and prevent leakage of the mix. Runways for buggies and wheelbarrows, if used, shall not be supported by form work. Concrete shall be conveyed in a manner which will not disturb forms.

(b) Concrete shall be placed in daylight; placing of concrete in a portion of the work shall not be started if that portion of the work cannot be completed during daylight, unless otherwise specifically approved by the Engineer. That approval will not be given unless an adequate lighting system is provided, and that system is approved by the Engineer.

(c) Concrete shall not be placed when the atmospheric temperature is cooler than 35 degrees Fahrenheit. If, after placing concrete, the atmospheric temperature becomes cooler than 35 degrees Fahrenheit, the Contractor shall enclose, heat, and protect the concrete in a manner which will keep the air surrounding the fresh concrete at a temperature not cooler than 45 degrees Fahrenheit for a period of 5 days after concrete is placed. The Contractor shall assume all risk connected with the cool weather placing and protecting of concrete and, should that concrete be unsatisfactory, it shall be rejected.

(d) Concrete shall be transported from the mixer to the point of deposit with a crane-handled bottom-dump concrete bucket, with concrete buggies, or with wheelbarrows. In the event the quality of the concrete as it reaches the forms, and the method and placing thereof, in the opinion of the Engineer, is not satisfactory, the Contractor shall change his method of operation so as to place concrete in a manner approved by the Engineer.

(e) Concrete shall be placed in a manner which will prevent the segregating of aggregates, displacing reinforcing, and coating and splattering the concrete reinforcing which is in place. Troughs, pipes, hoppers, chutes, and canvas tremies shall be arranged and used in a manner which will ensure that the concrete is placed in the manner specified. The placing of concrete within form work shall be regulated in a manner which will ensure that the pressure within the form work shall not exceed the design pressure of the form work. Concrete shall be placed in continuous horizontal layers, the thickness of which, in general, shall not exceed 12 inches. When placing concrete, each batch and each layer shall be placed immediately following the preceding batch and layer so that there will be no "cold joints" in the work. Care shall be used to fill each

part of the forms; concrete shall be deposited to as near final position as possible. After concrete has taken its initial set, care shall be used to avoid jarring the form work, and placing strain and vibration on the ends of projecting concrete reinforcements. If concrete must be dropped more than five (5) feet, it shall be deposited through a tremie.

(1) Concrete, when placed, shall be compacted with mechanical, internal vibrating equipment supplemented with hand-spading with a steel slicing rod. Vibrating shall not be used to transport concrete within forms. Vibrating equipment shall maintain an impulse rate of not less than 5,000 impulses per minute, when submerged in concrete. Not fewer than (1) spare vibrator shall be maintained on the jobsite as a relief. The duration of vibration shall be limited to that necessary to satisfactorily consolidate the concrete without causing objectionable segregation. The vibrator shall not be inserted into lower layers which have begun to set.

(2) Thin section work shall be thoroughly worked with a steel rod; faces shall be shaped and mortar flushed to the surface of the form. Small diameter holes shall be drilled in form work beneath large wall sleeves and inserts to prevent the entrapment of air beneath those sleeves and inserts when concrete is placed.

(f) Concrete shall be placed and compacted in a manner which will form a dense, compact, impervious structure having smooth faces on exposed surfaces. Concrete found to be porous, plastered, and otherwise defective, in the opinion of the Engineer, shall be removed and replaced in-whole, or in-part, as directed by the Engineer, at no additional expense to the Owner.

4.10 Construction joints shall be located where shown, and where directed by the Engineer. Concrete shall be placed continuously between construction joints so that the unit will be monolithic in construction. Not less than 72 hours shall elapse between casting of adjoining units, unless otherwise approved by the Engineer.

(a) Construction joints in footings and walls, required for proper execution of the work, but not shown, shall be located where directed by the Engineer, and across regions of low shearing stress so as to least impair the strength and appearance of the work. Special provisions shall be made for joining successive units as shown, and as directed by the Engineer.

(b) Construction joints in slabs, required for proper execution of the work, but not shown, shall be located where directed by the Engineer. Special provisions, including concrete footings for construction joints in slabs on earth, shall be made for joining successive units, as shown and as may be directed by the Engineer.

(c) Keys shall be constructed in construction joints where shown, and as directed by the Engineer. Keys and water stops shall be placed in those construction joints which will be subject to water pressure.

4.11 Expansion joints, when required, shall be located where, and constructed as, shown.

4.12 Bonding: Before placing new concrete work on, and against, concrete work

which has recently set, the surfaces of recently-set concrete work shall be thoroughly roughened and made free from all foreign matter and laitance, the forms placed and tightened, and the surfaces of that concrete slushed with grout. New concrete shall be placed before grout has attained its initial set; bonding work shall be accomplished in a manner which will ensure complete bonding. 2" to 4" of grout shall be applied to construction joints.

4.13 Form Work shall be constructed, braced, and removed in accord with the following:

(a) Chamfer strips shall be placed in forms for all exterior corners.

(b) Form work shall be built to conform to the shape, lines, and dimensions of the concrete work. Forms shall be set to line and grade, and shall be braced, tied, and secured in a manner which will withstand placing of the concrete, and which will maintain shape and position. Forms shall be tight, and be substantially assembled to prevent bulging and the leaking of concrete. Joints shall be arranged vertically or horizontally. Temporary openings shall be arranged, where required, at the bottoms of wall forms and elsewhere, to facilitate cleaning and inspecting. Lumber used once in forms shall have nails removed, and surfaces in contact with concrete work thoroughly cleaned, before re-use. Wall sleeves, inserts, and openings shall be properly set in form work.

(c) Shores shall be used where necessary. If adequate foundations for shores cannot be obtained, trussed supports shall be provided. Structural members, and other work, which will be subject to additional loads during construction, shall be adequately shored to protect that work from distortion and damage.

(d) Forms shall not be removed until the member supported thereby has acquired sufficient strength to safely support its own weight, and the load imposed on it. Tie rod clamps shall be loosened 24 hours after concrete has been placed. Standard snap ties shall be removed when forms are stripped; care shall be taken to avoid spoiling concrete surface. Cutting ties back from the face of the wall will not be permitted. Under normal conditions, the time elapsing before the forms may be stripped shall be not less than that shown in the following schedule; the use of the schedule shall not relieve the Contractor from his responsibility for the safety of the structure. Wood forms shall be completely removed from all portions of the work so that no material will remain for termite infestation.

Slabs	14 Days
Columns and Pedestals	7 Days
Walls and Vertical Faces not Supporting Other Work	2 Days

4.14 Finishing: Exterior concrete surfaces shall be finished to levels not shallower than 12 inches below finish grade levels; inferior concrete surfaces and concrete surfaces exposed-to-view shall be finished. Interior of basins shall be finished to a level not less than 12 inches below water level. Concrete not exposed-to-view shall have edges tooled-off, and shall be pointed and spot finished to fill irregularities. Concrete to be painted or waterproofed shall be finished.

(a) When concrete has set sufficiently to permit, forms and form ties shall be carefully removed. Depressions resulting from removal of form ties, and other holes and rough places, shall be thoroughly wetted with water and pointed with non-staining, non-shrink sand-cement mortar.

(b) After pointed surfaces have sufficiently set, surfaces specified to be finished shall be kept wet with water, and shall be rubbed with a carborundum stone of medium fineness, or other equally as good abrasive, to bring the surface to a smooth texture and to remove all form and other marks. The paste formed by the rubbing may be rubbed down by floating with a canvas, carpet-faced, or cork float, or may be rubbed down with dry burlap.

4.15 Concrete Floor Surfaces and Slabs: Before constructing concrete slabs on earth, all piping which will be under these slabs shall be tested and retested until there is no leakage. The sub-grade shall provide a solid bearing, and shall be brought to a true and even plane. Where floor drains occur, floors shall be pitched thereto, as shown. The concrete shall have a comparatively dry consistency, and shall be screeded level, or to the proper grade. After compacting and vibrating the concrete, the surface shall be prepared to receive the specified finish. All floors, walks, platforms, stairs, and other slabwork shall have a wood float finish. Setting basin and tank floors shall have a smooth steel troweled finish. After screeding to the required grade while the concrete is still green, but has hardened sufficiently to bear the finisher's weight, the concrete surface shall be floated with wood float to a true and even plane, have no visible coarse aggregate, and be sufficiently rough to prevent slipping. Floor topping shall be applied where shown; sub-base shall be wire-brushed before sub-base has hardened, shall be swept clean, shall be thoroughly wetted, and shall be slushed with bonding grout; topping shall be floated and troweled twice and in a manner which will prevent the fine material from being drawn up. Floor hardener shall be applied in strict accordance with the hardener manufacturer's printed instructions. Other type finishes shall be as shown.

4.16 Curing and Protecting: Freshly-placed concrete shall be protected from rain and flowing water. Concrete shall not be allowed to dry out from the time it is placed until the expiration of the specified curing period. Methods of curing, unless otherwise approved by the Engineer, shall be as follows:

(a) Concrete shall be kept wet with clean water for a period of 10 days after placing.

(b) Curing may be accomplished by leaving forms in-place, for a period of 10 days, and keeping exposed surfaces of the concrete wet and the forms sufficiently wet to prevent opening of joints.

4.17 Watertightness: Concrete required to be watertight shall be proportioned, mixed, and placed in strict accordance with this Section. All concrete structures for holding and transporting water, and pits below ground level, shall be tested and shall be watertight; a drop in the water level of more than 1/4-inch in 24 hours will not be permitted when water holding structures are filled. All exposed surfaces of waterholding structures, and interiors of pits below ground water level, shall be free from visible damp spots and seepages before acceptance.

4.18 Imperfect and damaged work shall be satisfactorily removed; new work and materials, which are in accordance with the requirements of the Drawings and Construction Specifications, shall be furnished and installed at no additional expense to the Owner. Removal of concrete work and installation of subsequent work and materials, shall be accomplished in a manner which will not impair the strength of the structure.

4.19 Cleaning: Upon completion of work, all forms, equipment, protective covering and rubbish resulting therefrom shall be removed from the premises. Finished concrete surfaces shall be left in a condition satisfactory to the Engineer.

4.20 Special Concrete Work: Work under this Section of Specifications shall include the construction of all special concrete work shown on the Drawings and/or specified.

(a) Wash Water Troughs: Concrete wash water troughs shall be constructed in place in exact accordance with the details shown on the Drawings. Coarse aggregate shall be sized from 3/4" down. The concrete mix for the troughs shall be designed to produce concrete of 5,000 psi compressive strength. All surfaces of troughs shall be carefully finished with the lips of all such troughs carefully leveled one to the other by means of filling the filter with water and leveling all wash water trough lips so as to produce even flow over all troughs in each individual filter.

4.21 Precast Concrete Work:

(a) Pre-Cast Concrete Slab Roof Deck: Roof decks, unless otherwise shown on the plans, shall be precast lightweight channel or hollow core slabs. All slabs shall be composed of an approved brand of Portland cement and high grade aggregate, accurately graded and thoroughly mixed and vibrated for maximum density.

Depths for channel slabs shall be 2-3/4" for spans up to 6'-4" and 3-1/2" or greater for longer spans. Each leg shall be reinforced with a deformed bar accurately centered. Web thickness shall be one full inch, reinforced with galvanized wire mesh, accurately centered. Depths for hollow core shall be 4" as indicated on the Drawings. Channel slabs shall be designed for a safe uniform load of 65 pounds per square foot and ultimate load of 250 pounds per square foot. Hollow core slabs shall be designed for 60 pounds per square foot live load. All slabs shall have adequate bearing and joints shall be filled with an approved mastic in accordance with manufacturer's recommended practice.

4.22 Payment: No separate payment will be made for the work of this Section, except as may be specifically set forth in the Proposal. The cost of the work of this Section, and all costs incidental thereto, except the work which may be specifically set forth in the Proposal, shall be included in the price bid for the item to which the work pertains.

SECTION NO. 5

REINFORCING STEEL, STRUCTURAL STEEL, AND MISCELLANEOUS METAL

5.01 Scope: The work covered by this Section of Specifications consists of furnishing all materials and equipment and performing all labor necessary for furnishing and installing all reinforcing steel, structural steel, miscellaneous metal, and appurtenances as indicated on the Drawings, as specified, and as required for completion of all work under this Contract.

5.02 Drawings: The Contractor shall furnish to the Engineer for checking and approval six (6) copies of bending and placing details for steel bar reinforcing which shall show bar size, spacing, bending, and tagging identification, and six (6) copies of drawings covering structural steel work showing details of fabrication and erection of structural steel for checking and approval. No manufacture or fabrication shall commence until such drawings have been approved.

5.03 Reinforcing Steel: Bar reinforcement, wire mesh, and expanded metal reinforcement shall be furnished by domestic steel mills and in accordance with the following:

(a) Bar Reinforcement: Materials, fabrication, and placement of steel bar reinforcement shall be in accordance with the following:

(1) Materials: Steel bar reinforcement shall conform to the requirements of ASTM A615-75, (Grade 40), as amended to date, subject to the following restrictions.

Billet Steel: Billet steel shall be made by the open hearth process.

Cold Twisted Bars: The use of cold twisted bars will not be permitted.

Test Specimens: Test specimens shall be a minimum of 48 inches.

Deformed Bars: Steel bar reinforcement shall be of an approved deformed type, such that a mechanical bond will be provided between concrete and steel at frequent intervals.

(2) Fabrication: Steel bar reinforcement shall be cold bent to shapes indicated on the Drawings. Bending shall be done in the shop before shipment unless otherwise specified. Bending details for steel bar reinforcement shall conform to the requirements of the ACI Building Code (ACI-318-63) unless otherwise indicated on the Drawings or specified. Steel bar reinforcement shall be bent, bundled, and tagged in accordance with details furnished by the fabricator.

a. Splices: Steel bar reinforcement shall be furnished full

length unless otherwise indicated on the drawings, or approved by the Engineer. Splices, where permitted, shall be well distributed or located at points of low tensile stress. Splices and dowels, except when used in cantilever wall or slab construction shall lap not less than 30 times the diameter of the bar. Splices and dowels used in cantilever wall or slab construction shall lap 40 diameters. Splices in horizontal reinforcement shall be staggered. The minimum clear distance between spliced bars, except when bar clamps are specified, shall be 1-1/2 bar diameters, but in no case less than 1-inch, nor less than 1-1/2 times the maximum size of coarse aggregate.

b. Hooks: Hooks of 180° shall have a radius of bend on the axis of the bar of not less than three bar diameters plus an extension of four bar diameters at the free end. Hooks of 90° shall have a radius of bend on the axis of the bar of not less than four bar diameters plus an extension of twelve bar diameters at the free end.

c. Openings: Openings 12-inches and larger through concrete walls and slabs shall have a minimum of 8 extra diagonal bars in each face of the wall or slab of the same size as the largest bar in the wall or slab. The length of extra diagonal bars at openings shall be as shown on the drawings, or as directed by the Engineer.

d. Minimum Reinforcing: Concrete walls, slabs, and other concrete work shown on the drawings to have no reinforcing, shall have a minimum area of steel bar reinforcing equal to 0.003 times the cross-sectional area of the concrete work.

(3) Placing: Steel bar reinforcement shall be placed in the locations shown on the drawings and held securely in place during the placing of concrete. The pushing of short bars into new concrete work will not be permitted. Bar reinforcing in walls shall be spaced the proper distance from the face of the wall by the use of approved pre-cast concrete mortar blocks. Bar reinforcing in slabs or beams shall be spaced the proper distance from the bottom of the slab or beams by use of approved pre-cast concrete mortar blocks or stainless steel chairs. Vertical stirrups shall always pass around main tension members, and be securely attached thereto. Bar spacing, covering, minimum clearance, bond and anchorage shall conform to the requirements of the ACI Building Code (ACI-318-63), as amended to date, except as otherwise indicated on the drawings or specified.

(4) Fastening, Reinforcing, and Placing Concrete: Steel bar reinforcing, when properly placed, shall be securely wired together at intersections with 18 gauge black annealed wire. Prior to the placing of concrete, all mortar and other foreign matter which may reduce or destroy bond shall be removed from the reinforcement. No concrete shall be deposited until the placement of the reinforcing has been approved by the Engineer.

(b) Wire Mesh Reinforcement: Wire mesh reinforcement, when shown on the drawings or specified to be required in the work to be done, shall be furnished and placed in accordance with the following:

(1) Materials: Wire mesh reinforcement shall conform to the requirements of ASTM Standard Specifications A-185-75, as amended to date, and unless otherwise indicated on the drawings, shall be 4-inch by 4-inch mesh, of 6 gauge wire.

(2) Placement: Wire mesh reinforcement shall be secured in position by spacer bars and chairs. Spacer bars shall be lapped not less than 5 inches. Precast concrete mortar blocks may be used in lieu of metal chairs in slabs on ground. Mesh shall be checked for position during placing of concrete and any displacement corrected. Mesh shall overlap 1-inch at edges unless otherwise indicated on the drawings, and shall be securely tied at ends and overlap.

(c) Expanded Metal Reinforcement: Expanded metal reinforcement, when shown on the drawings or specified to be required in the work to be done, shall be of a type approved by the Engineer, of metal equal in quality to that specified for bar reinforcement; and when placed shall overlap each other sufficiently to maintain a uniform strength and shall be securely fastened at the ends.

(d) Reinforcement - Storage and Protection: Steel reinforcement shall be stored above the surface of the ground upon platforms, skids, or other supports, and shall be protected as far as is practicable, from mechanical injury and surface deterioration. When placed in the work, it shall be free from rust, dirt, scale, paint, oil, or other foreign matter which may reduce or destroy bond.

5.04 Structural Steel:

(a) Design: Design of structural steel members is based on ASTM A-36-75 steel. Other grades of steel specified in the latest AISC Specification may be used with the approval of the Engineer, provided the structure has the same capacity and same deflection. Fabrication and erection shall be in accordance with AISC requirements. Structural steel tube sections may be either extruded or fabricated from steel plate with welds ground smooth.

(b) Connections: Unless otherwise shown, connections shall be welded. Connection design shall be based on the full strength of the member for uniform loading. High strength bolting may be used for field connections, if approved by the Engineer.

(c) Welding: Welding under these specifications may be done by the MIG, TIG, or "electrode" method in accordance with AWS-ASTM Specification No. E-6012 (Electrode Method only). All welding shall be done with AC-DA wire (MIG,TIG), or coated electrodes. All weld joints shall be cleaned of weld spatter and flux. All cut edges and welds shall be ground smooth. In assembling and during welding, the component parts of built up members shall be supported and held by sufficient clamps and other adequate means to hold the parts in proper relation for welding.

(d) High Strength Bolting: High strength bolts shall be in accordance with ASTM A-325-74. Installation shall be in accordance with "Specifications for Structural Joints Using ASTM A-325 Bolts" published in October, 1962, by the ASCE Structural Division, and as follows:

(1) Calibrated wrenches shall be used to provide the specified bolt tension and shall induce a torque 5% to 10% in excess of this value.

When several bolts are used in a joint, the wrench shall be returned to "touch up" bolts previously tightened.

(2) The Contractor shall demonstrate to the satisfaction of the Engineer that bolts are tightened properly by re-applying torque tools as necessary.

5.05 Miscellaneous Iron and Steel: All steel and iron, including structural steel, ingot iron and other miscellaneous iron and steel work, shall be furnished, fabricated and erected in place as necessary for the complete construction of all work shown on the Drawings and/or specified.

(a) Structural Steel: Structural steel shall be furnished in accordance with the requirements of A.S.T.M. Standard Specifications "Structural Steel for Buildings", as amended to date. Fabrication and erection shall be in accordance with A.I.S.C. requirements. Painting shall be in accordance with the section "Painting" of these Specifications.

(b) Steel Joists: Steel joists where indicated on the Drawings to be required for construction of the work shall be furnished and erected as indicated on the Drawings and in accordance with the standard specifications of the Steel Joists Institute. Shop and field painting of steel joists exposed to view shall be as specified for structural steel.

(c) Bolts and Nuts: Bolts and nuts shall be of the best quality high strength steel, except where shown otherwise on the Drawings. They shall have hexagon nuts, but may have square heads. Heads and nuts shall have the under-surfaces true and at right angles to the axis of the bolts. Bolts shall have sound, well-fitting, truncated "V" threads, American National coarse-thread standard. When bolts are used in place of rivets, they shall have a driving fit. Bolts and nuts in general shall be of United States Standard dimensions. All interior and anchor bolts embedded in concrete shall be of cadmium plated mild steel, except where shown otherwise on the Drawings, or specified. All anchor bolts exposed to the weather shall be of stainless steel, Type 316, unless otherwise specified.

(d) Concrete Anchors: Anchor bolts in general shall be placed in forms prior to pouring concrete. When concrete anchors must be used, they shall be Phillips "Red Head" self-drilling anchors, or approved equal.

(e) Workmanship: Workmanship shall be first-class in every respect and shall conform to the latest and best practice, as set forth in the latest specifications of the American Institute of Steel Construction. All material shall be thoroughly straightened in the shop by methods that will not injure it before templates are placed on same for laying off and before any work is done upon it. All materials shall be kept clean and protected from the weather.

(f) Welding: Welding under these Specifications may be done by the MIG, TIG, or "Electrode" method in accordance with AWS-ASTM Specification No. E-6012 (Electrode Method only). All welding shall be done with AC-DC wire (MIG, TIG), or coated electrodes. All weld joints shall be cleaned of weld spatter and flux. All cut edges and welds shall be ground smooth. In assembling and during welding, the component parts of built up members shall be supported and held by sufficient clamps and other adequate means

to hold the parts in proper relation for welding.

(g) Drawings: Where details are shown on the drawings, the structural steel work shall conform accurately to them. Where the drawings are diagrammatic, the Contractor shall design the connections in accordance with the best shop practice and so as to develop the full strength of the members. The Contractor shall furnish for approval, complete shop drawings showing all framed work and all connections to concrete or other masonry, and shall also furnish all necessary erection drawings.

(h) Shop Painting: Except as otherwise specified, exposed surfaces of steel and iron shall be painted in the shop as specified under "Painting". Contact for bolting or welding in the field shall be left bare and painted promptly after the field welding or bolting is completed.

5.06 Iron Castings: The Contractor shall furnish and install all miscellaneous iron castings, including catch basin and manhole frames, covers, steps, floor drains, bolt inserts, brackets, supports and such other iron castings as are shown on the plans.

(a) Castings, unless otherwise specified, shall be of gray-iron conforming to Federal Specifications QQ-T-652C.

(b) Malleable castings shall conform to Federal Specifications QQ-I-666 D.

(c) All castings shall be tough, close-grained and smooth, and free from blow holes, blisters, shrinkage stains, cracks, cold shots, and like defects. No plugging of defective castings will be permitted.

(d) Workmanship: All castings shall be made accurately to dimensions shown on the plans or ordered and shall be planed or ground where necessary, whether marked or not, to secure perfectly flat bearing surfaces. Allowance shall be made in the patterns so that the specified thickness of metal will not be reduced.

(e) Weights: No castings will be accepted, the weight of which is less than the theoretical weight, based on required dimensions, by more than five (5%) per cent.

(f) Cleaning and Painting: All castings shall be thoroughly cleaned and painted before rusting begins. All castings except those to be embedded in concrete, shall be cleaned and given a priming coat of paint in the shop. Castings which will be exposed in buildings shall be painted in accordance with the section "Painting". Castings which are to be installed outdoors, such as manhole frames, covers, and steps, shall be given 2 coats of approved bituminous paint in the shop.

5.07 Nosings for Concrete Treads: Nosings of all concrete steps, interior, and exterior, shall be provided with Wooster, Type 231, Abrasive Safety Treads, securely anchored to concrete.

5.08 Stainless Steel: Unless otherwise specified, all bolts, nuts, and fabricated work indicated on the plans and/or specified to be stainless steel shall be Type 316, made under ASTM A-276-75.

5.09 Aluminum: Aluminum work shall be furnished and installed as indicated on the Drawings, and as specified below.

(a) Aluminum Railing: Aluminum railing shall be fabricated from aluminum Schedule 40 pipe, 6061-T6 alloy, 1-1/2" size, with continuous welded joints. Welding shall be by inert gas shield arc method, with all welds ground smooth. All welded railing shall be shop fabricated.

(b) Aluminum Grating: Solid and punched aluminum planking shall be aluminum planking as manufactured by Borden Metal Products Company, or approved equal. All planking shall be banded and sections under 6" shall be fastened together as recommended by the manufacturer and banded in sections not more than 24 inches wide.

All other grating, except as specified above, shall be plain top, cold forged, button design swaged, aluminum gratings as manufactured by Bustin Aluminum Products Corporation, or approved equal.

Grating and planking in concrete areas shall have aluminum bearing angles anchored in concrete to form grating frames. Aluminum surfaces in contact with concrete shall have one coat of Metal Conditioner and one coat of Inertol No. 49 applied in the field. Cuts in grating around piping and other openings, as well as ends of bearing bars shall be banded. Grating layout shall be made from approved piping and valve layout drawings. Welding shall be by the inert gas shielded arc method, and performed where least exposed to view. Banding shall be aluminum extruded sections with grating coped for tight fit and welded only as necessary for strength and tight fit. All welds shall be cleaned and ground smooth.

5.10 Steel Grating: Steel grating shall be galvanized, unpainted and shall conform to specifications listed in 5.09(b). Steel grating shall be used where shown on the Drawings. Steel grating supports, grating stops, anchor clips and hardware shall be galvanized after fabrication and remain unpainted.

5.11 Canopy Steel Decking: Panels shall be made with a minimum of 24-gage steel having a minimum yield point of 37,000 psi in accordance with ASTM A-446-72, Grade B. Panels shall have a male and female rib for interlocking panels and shall be sculptured embossed. Joints shall be not more than 16 inches on center. Panels shall be aluminum coated with a minimum weight of coating of 0.75 ounce determined in accordance with Military Specification MIL-S-4174-A. Panels shall be "Steelox" decking as manufactured by Armco Steel Corp., Metal Products Division, or approved equal.

5.12 Aluminum Recording Tablet: The Contractor shall furnish and install one aluminum recording tablet, to be mounted in a location as directed by the Engineer.

(a) Castings: Castings shall be of cast aluminum, #214 alloy of virgin material, free from pits, blow holes or hidden imperfections. The tablet shall have a minimum thickness of not less than three eighths (3/8") of an inch. The borders and all lettering shall be raised approximately one-eighth (1/8") of an inch. The borders shall be approximately three-eighths (3/8") of an inch wide. The outside dimensions of the tablet shall be twenty-four (24") inches wide by thirty (30") inches high,

containing project caption names of City Officials, Contractors, and Engineers. Border and letters shall be hand chased and satin polished natural color. The field shall be of dull aluminum pebble finish. The finished work shall be protected with finest transparent lacquer. The tablet shall be fastened upon a masonry wall face. The tablet shall be furnished with suitable expansion shields and bolts with rosette covers. The lettering shall be of varying sizes. Letters shall be flat faced Roman, raised approximately one-eighth (1/8") of an inch, and shall be consistent with established practice for first class commercial tablet work. The Engineer will furnish typewritten copy of the desired caption, names and arrangements of lettering.

(b) Drawings: The manufacturer shall be required to furnish full shop drawings or rubbings for verification and approved by the Engineer before casting.

5.13 Steel Pipe Railing: Pipe railing shall be galvanized iron pipe, 1-1/2" size, with welded fittings. All railing posts shall be set in pipe sleeves to a depth of 4-inches and furnished with escutcheon plates when used with tile floors. Aluminum Railing shall be used except where steel railing is called for on the plans.

5.14 Payment: No separate payment shall be made for work under this Section of the Specifications, except as set forth in the Proposal. The cost of such work and all costs incidental thereto shall be included in the price bid for the item to which the work pertains.

SECTION NO. 6

STORM DRAINS, SEWERS AND APPURTENANCES

6.01 Scope: Work under this Section of the Specifications consists of furnishing all materials and equipment and performing all labor necessary for the installation of clay, concrete, and/or ductile iron storm drains and sewer lines with appurtenances, complete to limits shown on the Drawings and specified.

6.02 Sewer Pipe: Unless noted on the drawings to be vitrified clay or ductile iron, all sewer pipe shall be concrete. Sewer pipe shall be furnished in accordance with the following requirements:

(a) Quality: All pipe shall be first quality, with smooth interior and exterior surfaces, free from cracks, blisters and other imperfections, and true to theoretical shapes and forms throughout the full length.

(b) Inspection: All pipe shall be subject to inspection by the Engineer at the pipe plant, trench, or other point of delivery for the purpose of culling and rejecting pipe, independent of laboratory tests, which does not conform to the requirements of these Specifications.

(c) Experience of Manufacturer: The manufacturer of the pipe shall submit evidence, if requested by the Engineer, of having previously, consistently produced both pipe and joints in conformance with the requirements of these Specifications.

(d) Vitrified Clay Pipe:

(1) General Requirements: Vitrified clay sewer pipe shall be bell and spigot and shall conform to the following A.S.T.M. Specifications.

a. Standard Strength Pipe: C700-74, except as otherwise provided herein.

b. Extra Strength Pipe: C700-74, except as otherwise provided herein.

(2) Size 12-inch and Smaller: All pipe shall be in lengths of at least 4 feet and shall be extra strength pipe.

(3) Minimum Crushing Strength: All pipe when tested for crushing strength by the 3-edge bearing method in accordance with A.S.T.M. Specifications C301-72 shall have a minimum strength of not less than the following values:

Pipe Size	Minimum Strength - Lbs. Per Lin. Ft.
	Extra Strength
6"	2,000
8"	2,000
10"	2,000
12"	2,250

(4) Absorption: Absorption shall not exceed 6 per cent when determined in accordance with A.S.T.M. Specification C301-72.

(5) Joints: All pipe shall have highest quality, factory-molded joints meeting all requirements of A.S.T.M. Specifications C425-74, or couplings conforming to ASTM Specification C594-74.

(6) Testing: Pipe, joint materials and made-up joints shall be tested by an independent laboratory, approved by the Engineer, in accordance with the applicable A.S.T.M. Specifications set forth in the "Control of Materials" section.

Crushing and absorption tests will be required for all sizes of pipe used in the work. In addition to the number of test specimens provided for the standard specifications, at least one joining of pipe of each size, for sizes 6, 8, 10 and 12-inch pipe shall be selected from each separate shipment of pipe for crushing and absorption tests.

(e) Non-reinforced Concrete Pipe:

(1) General Requirements: Non-reinforced concrete pipe shall be bell and spigot and shall conform to A.S.T.M. Specification C14-74, Table II, for extra strength pipe, except as otherwise provided herein. Pipe shall be furnished in lengths of at least 4 feet. Only size 12-inch and smaller will be permitted under this Specification.

(2) Minimum Crushing Strength: All pipe when tested for crushing strength by the 3-edge bearing method in accordance with the standard specifications shall have a minimum strength of not less than the following values:

Pipe Size	Minimum Strength - Lbs. Per Lin. Ft.
6"	2,000
8"	2,000
10"	2,000
12"	2,250

(3) Absorption: Absorption shall not exceed 6 per cent when determined in accordance with the Standard specifications.

(4) Joints: All pipe shall have O-ring rubber gasket type joints conforming with the applicable provisions of A.W.W.A. Specification C302-74. A rectangular groove shall be provided in the spigot end to receive the rubber gasket and it shall be so formed that when the joint is complete the gasket will be deformed to a rectangular shape and confined on all four sides. Bell and spigot surfaces shall be accurately formed and smooth to provide a close sliding fit with a nominal clearance of 1/16-inch between the bell and the spigot.

(5) Alternate Joints: Pipe shall be bell and spigot offset pipe coupled with "Tylox, Type CR" rubber gaskets. The materials, manufacture, physical requirements and properties of gaskets shall conform to the applicable provisions of A.S.T.M. Specification C443-74.

The inside taper of the pipe bell shall not exceed a slope of 5 degrees from the horizontal. The offset portion of the spigot end of the pipe shall be of such depth that the annular space occupied by the compressed gasket shall not exceed 5/16-inch. Bell and offset spigot surfaces shall be accurately formed, true to shape, smooth and free from projections and rough spots, to permit gaskets to be in contact with the pipe at all points around the circumference of the pipe.

(6) Repaired Pipe: Repaired or patched pipe or repairs to or patching of gasket grooves or shoulders will not be permitted.

(7) Testing: Pipe shall be tested by an independent laboratory approved by the Engineer, in accordance with the applicable A.S.T.M. Specifications set forth in the "Control of Materials" section.

Crushing and absorption tests will be required for all sizes of pipe used in the work. In addition to the number of test specimens provided for the standard specifications, at least one joint of pipe of each size shall be selected from each separate shipment of pipe for crushing and absorption tests.

Prior to the delivery of any pipe, and with advance notification to the Engineer, made-up gasketed joints shall be tested for shear loading at a total load of 100 pounds per inch of diameter, including the weight of the pipe, water and test apparatus. The load shall be uniformly applied to the spigot and over an arch of not less than 120 degrees for a longitudinal distance of 12-inches immediately adjacent to the bell, with the pipe supported on blocks behind the bells during the test procedure. There shall be no visible leakage when tested with an internal water pressure of 5 psi for a period of one hour.

(f) Reinforced Concrete Pipe:

(1) General Requirements: Reinforced concrete pipe shall be bell and spigot and shall conform to the following A.S.T.M. Specifications:

a. Standard Strength Pipe: C76-74, Table III, except as otherwise provided herein.

b. Extra Strength Pipe: C76-74, Table IV, except as otherwise provided herein.

(2) Cement and Coarse Aggregate: Cement shall be Type 2. Coarse aggregate shall be crushed granite or limestone.

(3) Manufacture: Pipe shall be centrifugally spun and shall be furnished in lengths of at least 12 feet.

(4) Minimum Crushing Strength: All pipe when tested by the 3-edge bearing method in accordance with the standard specifications shall have a minimum strength (defined as the load to produce a 0.01-inch crack) of not less than the following values:

Pipe Size	Minimum Strength - Lbs. Per Lin. Ft.	
	Standard Strength	Extra Strength
15"	1690	2500
18"	2025	3000
21"	2365	3500
24"	2700	4000
27"	3000	4500
30"	3375	5000
36"	4050	6000
42"	4725	7000
48"	5400	8000
54"	6075	9000
60"	6750	10000

(5) Absorption: Absorption when determined in accordance with the standard specifications shall not exceed 6 per cent.

(6) Joints: All pipe shall have O-ring rubber gasket type joints conforming with the applicable provisions of A.W.W.A. Specifications C302-74. Joint assemblies shall consist of either (1) concrete bell and spigot ends or (2) steel bell and spigot rings. A rectangular groove shall be provided in the spigot end to receive the rubber gasket and it shall be so formed that when the joint is complete the gasket will be deformed to a rectangular shape and confined on all four sides. Bell and spigot surfaces shall be accurately formed and smooth to provide a close sliding fit with a nominal clearance of 1/16-inch between the bell and the spigot. All exposed surfaces of steel bell and spigot rings shall be protected by a coating of zinc applied by an approved metallizing process.

(7) Repaired Pipe: Repaired or patched pipe will not be acceptable unless each individual pipe so repaired or patched has been inspected and approved by the Engineer. Repairs to or patching of gasket grooves or shoulders will not be permitted.

(8) Testing: Pipe shall be tested by an independent laboratory approved by the Engineer, in accordance with the applicable A.S.T.M. Specification set forth in the "Control of Material" section.

Pipe will be accepted on the basis of results of 3-edge bearing tests, both for the load to produce a 0.01-inch crack and the ultimate load; by absorption tests on selected samples from the wall of the pipe; and by inspection of the finished pipe. Pipe in lengths of other than the nominal laying length, but not less than 4 feet, may be used for load bearing tests with approval by the Engineer.

6.03 Ductile Iron Pipe: Ductile iron pipe for sewers shall be furnished in accordance with the requirements of Section No. 7 of these Specifications.

6.04 Jointing Compound for Sewer Pipe: Jointing compound, for hot-poured joints where permitted by the Engineer or where required for special connections, shall be a filled hydrocarbon plastic, shall adhere firmly to the surface of the pipes, shall melt and run freely at a temperature of four hundred and thirty (430) degrees F., and when set shall be sufficiently elastic to

permit a slight movement of the pipes without injury to the joints, or breaking the adhesion of the compound to the pipes. The compound shall not deteriorate when submerged in fresh or salt water or normal domestic sewage. It shall show no deterioration of any kind when immersed for a period of sixty (60) days in a five per cent solution of each of the following compounds: H_2SO_4, NaOH, KOH, and NAOCl. The plastic compound shall be JC-60 compound as manufactured by the Atlas Mineral Products Company of Mertztow, Pennsylvania, or approved equal. Priming solution shall be used for all types of sewer pipe and shall be applied to both the exterior surface of the spigot and the inside of the bell at least one day before pipe is laid. Priming solution shall be Atlas No. 60 Primer, or approved equal.

6.05 Concrete and Cement Mortar: Concrete of the respective classes for structures, manhole bottoms, bedding and encasement shall conform to the applicable provisions of the "Concrete Work" section.

Cement mortar for brick work and inverts of manholes shall be made of one part Portland cement and two parts of clean, sharp, masonry sand.

6.06 Reinforcing and Structural Steel: Materials, fabrication and installation of reinforcing and structural steel shall conform to all provisions of the "Reinforcing Steel, Structural Steel, and Miscellaneous Metal" section, respectively, and to the details shown.

6.07 Iron Castings: Materials, fabrication and installation of iron castings shall conform to all provisions of the "Reinforcing Steel, Structural Steel, and Miscellaneous Metal" section, and to the details shown.

6.08 Manhole Brick: Brick for manhole construction shall be whole, uncored, hardburned, common brick conforming in all respects to ASTM C32-73, Grade MA.

6.09 Inspection: All work done and materials furnished shall be subject to inspection by the Engineer. All improper work shall be reconstructed, and all materials which do not conform to the requirements of the Specifications shall be removed from the work upon notice being received from the Engineer of the rejection of those materials. The Engineer shall have the right to mark rejected materials, and to distinguish them as such.

6.10 Excavation: The top portion of sewer pipe trenches may be excavated with sloping or vertical sides to any width which will not cause damage to adjoining structures, roadways, pavements, utilities or private property. The width of the lower portion of the trench to a height of two feet above the top of the pipe shall not exceed the width shown in the tabulation under Paragraph 6.15 of this section of Specifications. If trenches are excavated to widths in excess of these limitations or collapse because of unsuitable or insufficient bracing and sheeting, the Contractor will be required to use special methods of constructing pipe foundations and of backfilling as specified herein at no additional expense to the Owner. Where rock excavation is encountered at grade the trench shall be excavated not less than 8 inches below the barrel of the pipe, or to such greater depth as may be required by the provisions of Paragraph 6.14 following, and refilled with thoroughly compacted crushed stone or gravel in accordance with the class of bedding required for the particular location. Rock shall be removed so as to provide a clearance of not less than 8-inches in any horizontal direction from pipe and appurtenances.

6.11 Bracing and Sheeting: The sides of all trenches and excavation for

structures shall be securely held by stay bracing, or by skeleton or solid sheeting and bracing, as required by the soil conditions encountered, unless otherwise permitted by the Engineer.

(a) Removal of Bracing and Sheeting: Bracing and sheeting may be removed in units when the level of backfilling has reached the elevation necessary to protect the pipe work and to protect adjacent property. Sheeting near the bottom of trenches which are over ten feet deep for sewers of 15" size and larger shall remain in place and shall be cut off not less than two feet above the top of the completed sewer. When, in the opinion of the Engineer, sheeting or shoring above this level cannot be safely removed, it shall be left in place. Timber so ordered to be left in place shall be cut off at least two feet below the surface.

6.12 Dewatering Trenches: All excavation shall be dewatered properly before laying pipe. Where running sand is encountered, dewatering shall be done by well pointing whenever possible. Where soil conditions are not favorable for use of well point, french drains of crushed stone or gravel shall be constructed to suitably located sumps and the water removed by bailing or pumping.

6.13 Crushed Stone Stabilization: Whenever the subgrade is by nature too soft or mucky, in the opinion of the Engineer, for the proper installation of the sewer, he may order the Contractor to undercut the trench and backfill with crushed stone or gravel, 3/4-inch in size and less. The stone so placed shall be brought to the subgrade required by the class of bedding required for the particular location and compacted.

6.14 Bedding of Pipe: All pipe shall be laid on foundations prepared in accordance with the various classes of bedding required by the trench width and trench depth for the size of pipe to be laid, as shown on the drawings and/or as specified as follows:

(a) Class A Bedding: Class A bedding shall be either a concrete arch or concrete cradle. Concrete shall be Class B and shall be poured to the full width of the trench. Pipe shall be laid to line and grade on concrete blocking where the cradle method is used, after which the concrete shall be placed to the limits shown.

(b) Class B Bedding: Class B Bedding shall be either a compacted, coarse granular material placed on a flat bottom trench, or a shaped trench bottom with a layer of compacted, fine, moist, granular material. The shaped bottom method may be used only where trenches are dry and suitable foundation and backfill material is available.

(c) Class C Bedding: Class C bedding shall be either a compacted, coarse granular material placed on a flat bottom trench, or a shaped trench bottom with bell holes. The shaped bottom method may be used only where trenches are dry and suitable foundation and backfill material is available.

(d) Class D Bedding: Class D bedding, as shown on the detail plans, shall be a flat bottom trench with bell holes, and may be used only with the approval by the Engineer, for pipe sizes 6-inch to 12-inch inclusive, in dry trenches having suitable foundation and backfill material, and to the depths tabulated in Paragraph 6.15.

(e) Bell Holes: Bell holes shall be provided in all classes of bedding so as to relieve pipe bells of all load, but small enough to insure that support is provided throughout the length of the pipe barrel.

(f) Stone or Gravel Bedding Material: Stone or gravel bedding material shall consist of crushed stone or pea gravel, clean and graded, 95 to 100 per cent of which shall pass a 1/2-inch sieve with 95 to 100 per cent retained on a No. 4 sieve. Bedding material shall be placed on a flat bottom trench and thoroughly compacted by tamping or slicing with a flat-blade shovel. Compacted bedding material shall be carried up the sides of the pipe to the heights shown on the detail plans for the various classes of bedding.

(g) Excess Trench Widths: If trenches are excavated to widths in excess of those specified in Paragraph 6.15 or trench walls collapse, pipe shall be laid in accordance with the requirements for at least the next better class of bedding at the expense of the Contractor.

6.15 Maximum Trench Widths and Depths: Maximum trench widths and depths for the respective pipe sizes with the various classes of bedding and tamping shall be in accordance with the following:

Table 1. Vitrified Clay or Non-Reinforced Concrete Pipe
Sizes 6-inch to 12-inch inclusive
Extra Strength Pipe Only

Size Pipe	Maximum Trench Width	Maximum Trench Depth Class D Bedding	Class C Bedding	Class B Bedding	Class A Bedding
6"	2'-0"	12'	27'	30'	35'
8"	2'-2"	10'	18'	30'	35'
10"	2'-4"	9'	15'	26'	35'
12"	2'-6"	9'	15'	26'	35'

Table 2. Reinforced Concrete Pipe - Size 15-inch and Larger

		Maximum Trench Depth					
		Table III Pipe Standard Strength			Table IV Pipe Extra Strength		
Size Pipe	Maximum Trench Width	Class C Bedding	Class B Bedding	Class A Bedding(1)	Class C Bedding	Class B Bedding	Class A Bedding
15"	2'-10"	10'	14'		18'	32'	35'
18"	3'- 2"	11'	15'	31'	19'	32'	35'
21"	3'- 6"	11'	15'	31'	20'	32'	35'
24"	3'-10"	12'	16'	31'	20'	32'	35'
27"	4'- 3"	12'	16'	27'	19'	28'	35'
30"	4'- 9"	12'	16'	26'	19'	26'	35'
36"	5'- 5"	13'	16'	26'	19'	26'	35'
42"	6'- 1"	13'	17'	26'	20'	26'	35'
48"	6'- 9"	14'	17'	26'	20'	27'	35'
54"	7'- 5"	15'	18'	27'	21'	27'	35'
60"	8'- 1"	15'	19'	27'	22'	27'	35'

(1) Table IV Pipe on Class B Bedding may be substituted.

6.16 Laying Pipe: All sewer pipe shall be laid upgrade with the spigots pointing downgrade. The pipe and specials shall be so laid in the trench that after the sewer is completed the interior surface shall conform on the bottom accurately to the grades and alignment fixed or given by the Engineer.

The interior of all pipes shall be carefully freed of all dirt and superfluous material of every description, as pipe laying proceeds. Defective joints discovered after laying shall be repaired and made tight. Defective pipe shall be removed and proper replacement made.

(a) Clay Pipe with Moulded Joints: The surfaces of the pipe to be joined as well as the moulded surfaces of the joint shall be wiped free of dust, dirt, gravel and other foreign substance. After the surfaces have been thoroughly cleaned, the mating surfaces of the joint shall be brushed with the proper type of lubricant sealer, as supplied by and in accordance with the recommendations of the manufacturer.

The spigot end shall then be centered on grade into the bell and of the preceding pipe and shoved home and properly seated with the application of a moderate force by a pry or lever device. Pipes shall be joined no later than five minutes after the application of the sealer. In the event there is a delay of longer than five minutes between sealing and jointing, the lubricant sealer shall once again be applied. Immediately after joining the pipes, the last pipe shall be brought to final alignment and grade. Every third pipe shall be filled around immediately after being properly placed to prevent the moving of joint.

(b) Concrete Pipe with "O-Ring" Type Rubber Gasket Joints: The surfaces of the pipes to be joined, as well as the rubber gaskets, shall be cleaned and lubricated with a vegetable soap to permit uniform placement in accordance with the manufacturer's instructions.

The gasketed spigot end of the pipe shall then be centered on grade into the bell of the preceding pipe and shoved home and properly seated with the application of a moderate force by a pry or lever device. Immediately after joining the pipes, the last pipe shall be brought to final alignment and grade. After each joint is made, the gasket shall be checked for proper position in the groove. Care shall be used to prevent pinching or cutting of the gasket during installation. If the gasket is out of position or has been damaged in any way, the pipe shall be removed and relaid with a new gasket.

Every third pipe shall be immediately filled around after being properly placed, to prevent the moving of joints. External and internal recesses at each joint shall be filled with cement mortar whenever such construction is recommended by the manufacturer.

(c) Ductile Iron Pipe with Mechanical Joints: Proper and suitable tools and equipment, for the safe and convenient handling and laying of ductile iron pipe shall be used, and proper care shall be exercised to prevent damage to the exterior coating and the interior cement lining. Whenever pipe is required to be cut, the cutting shall be done by skilled workmen using pipe cutters. The use of hammer and chisel and/or cutting torch will not be permitted.

Joints shall be made only by experienced mechanics. Sockets and spigots

shall be washed with soapy water before slipping the gland and gasket over the spigot end of the pipe. The spigot shall be inserted into the socket full depth. The gasket shall be brushed with soapy water and shall be pushed into position making sure that it is evenly seated in the socket. The gland shall then be moved into position for compressing the gasket. All bolts and nuts shall be tightened "finger-tight". For joints made in trenches, the bolts shall then be tightened to a uniform permanent tightness, using a torque wrench for tightening. Bolts shall be tightened alternately 180 degrees apart.

Where joints are made with pipe on concrete piers, the bolts shall be left "finger-tight" until such time as sewage is diverted into the sewers, when bolts may be further tightened just a sufficient amount to prevent leakage of the joint but not prevent slippage which may occur because of temperature stress.

(d) Hot-Poured Plastic Joints: Hot-poured plastic joints may be used, where permitted by the Engineer, for making special pipe connections. Space between the pipe bell and spigot shall be made as uniform as possible by properly caulking a gasket of twisted, dry jute into the joint in such manner that at least 1-1/2 inches of depth in the bell will be available for jointing material. Tarred gaskets will not be permitted. The joint shall then be completely filled with hot-poured plastic compound. The methods employed in melting and pouring compound shall be exactly in accordance with the manufacturer's instructions.

No joints shall be poured where pipe surfaces to be joined have been soiled with earth in handling, until such soiled surfaces have been thoroughly cleaned by wire brushing and wiping with a clean cloth. No plastic joints shall be poured where water or moisture is present and the pipe is not kept clean and dry.

6.17 Closing Pipe: When the work of pipe-laying is suspended, either for the night or at other times, the end of the pipe must be closed with a tight cover. The Contractor shall be held responsible for keeping the pipe free from obstruction.

6.18 Concrete Encasement of Pipe: Where called for on the plans, or where otherwise directed by the Engineer, sewer pipe shall be completely encased with Class "C" concrete. The trench shall first be excavated not less than 6 inches below the bell of the pipe and the pipe laid to line and grade on concrete blocking. Concrete shall then be poured to the full width of the trench, but in no case less than 6 inches from the pipe bell on either side of the trench, and to a height of not less than 6 inches above the top of the pipe bell. No backfill material shall be placed in the trench for a period of at least 24 hours after the concrete encasement has been poured.

6.19 Selected Backfilling: All trenches shall be backfilled immediately after pipes are laid therein and joints inspected by the Engineer, unless other protection of the pipeline is directed. Selected backfill material shall consist of finely divided earth, stone dust, sand or other approved material, carefully placed about the pipe and up to a height of at least 24 inches above the top of the pipe barrel, in uniform layers not exceeding 6 inches in thickness, each layer thoroughly compacted with proper hand tools in such manner as not to disturb or injure the pipe. Backfilling shall be carried on simultaneously on both sides of the pipe in such a manner that injurious side pressures

do not occur. If suitable select materials are not available from trench excavation, the Contractor will be required to obtain them elsewhere at his own expense.

6.20 General Backfilling: After selected backfill material has been placed and tamped, the remainder of the trench may be backfilled with general excavated material, provided such material shall not contain more than 1/3 broken rock, of which no single stone or boulder shall weigh more than 25 pounds. Backfill material shall be placed in uniform layers not exceeding 12 inches in thickness, with each layer thoroughly compacted with heavy duty power tamping tools of the "Wacker" type, to the full satisfaction of the Engineer. The use of power "Jumping Jack" tampers will not be permitted.

Whenever the trenches have not been properly filled, of if settlement occurs they shall be refilled, smoothed off and finally made to conform to the surface of the ground. Backfilling shall be carefully performed and the original surface restored to the full satisfaction of the Engineer. Surplus material shall be disposed of as directed by the Engineer.

6.21 Concrete Piers and Cut-Off Walls: Concrete piers and cut-off walls for sewers or force mains shall be constructed of Class A concrete and shall conform to the details shown on the plans. A saddle conforming to the outside of the pipe shall be constructed on the top of all piers. Pipe shall be blocked to proper grade and then grouted in place in the saddle with 1:2 cement mortar. Pipe straps shall be installed on all piers.

6.22 Leakage: Leakage of ground water into sewers shall not exceed the following maximum rates:

Size of Sewer	Gallons per ft. of Sewer per day
6"	0.65
8"	0.85
10"	1.00
12"	1.10
15"	1.25
18"	1.35
21"	1.50
24"	1.65
27"	1.80
30" and Larger	1.90

(a) Leakage tests shall be made only when the ground water table is above the top of the pipe and after all visible leaks have been stopped. In case leakage exceeds the rates above specified, the sewer will not be accepted until so repaired that it will comply with these requirements.

6.23 Testing and Cleaning: Before acceptance of the sewer system, it shall be tested and cleaned to the satisfaction of the Engineer. Where any obstruction is met, the Contractor will be required to clean the sewers by means of rods or swabs or other instruments. The pipe line shall be straight and show a uniform grade between the manholes.

6.24 Manholes: Manholes, catch basins, and drop inlets shall be constructed at such locations as are shown on the plans and as may be directed by the Engineer, on conformance with details shown on the plans. Manholes may be brick or

precast concrete at the Contractor's option.

(a) Brick Manholes: The bottom of each brick manhole shall be constructed of Class B concrete and the walls shall be built of whole hard-burned brick laid in cement mortar. Every brick shall be embedded in mortar on its bottom and sides, and the walls shall be thoroughly plastered on the outside walls with a smooth coat of 1:2 cement mortar as shown on the detail sheet of the Drawings. Brick shall be properly wet before being incorporated in the work. Reinforcing, if shown on the plans, for brick masonry shall conform with details shown on the Drawings, each hoop bar shall be completely bonded in the mortar joint between brick courses.

Manhole inverts shall be carefully constructed, with special care exercised in laying the channels and adjacent pipes to grade. Channels shall be properly formed and rounded and shall be trowelled smooth. The connection of the sewer with the wall and channel of the manhole shall be tight and smooth. Manhole inverts shall be constructed by working from the outside of the manhole structure wherever feasible, and at such time as the brick work has reached a point above the top of the largest pipe not in excess of 12 inches.

Manhole steps shall be in accordance with the details shown on the plans and shall be firmly and securely built into the walls of the manhole as brickwork proceeds.

(b) Precast Concrete Manholes: If precast concrete manholes are substituted for the brick manholes, the precast concrete manholes shall be constructed of reinforced Class "A" concrete. Walls shall be not thinner than 5 inches; gaskets shall be "O-ring", rubber type; joints and gaskets shall conform to the applicable provisions of ASTM C443-74. A rectangular groove shall be provided in the spigot end of the pipe to receive the circular rubber gasket, and shall be formed so that when the joint is complete, the gasket will be deformed to the shape of the groove and confined on all four sides. Bell and spigot surfaces shall be smooth, accurately formed and provide a close, sliding fit, and a clearance between the bell and spigot of not more than 1/16". Manholes shall be bedded on not less than 6 inches of compacted crushed stone at Contractor's expense.

6.25 Payment: No separate payment will be made for work under this Section of Specifications, except for crushed stone stabilization if ordered by the Engineer. The cost of all such work and all costs incidental thereto shall be included in the price bid for the item to which the work pertains.

Crushed stone stabilization, if ordered by the Engineer, will be paid for as a separate item, as provided for in the Proposal, for quantities actually installed in the field as directed by the Engineer and as specified herein.

Crushed stone stabilization, if ordered by the Engineer because subgrade was disturbed by the Contractor's operations, improper dewatering of the excavation or any other reason except as specified in Paragraph 6.13 will not be paid for as a separate item. The cost of all such work and all costs incidental thereto, including earth excavation necessary for the placement of the crushed stone stabilization, shall be included in the price bid for the crushed stone stabilization.

Excavation is unclassified and part of the lump sum bid. There will be no separate payment for Rock Excavation.

SECTION NO. 7

METAL PIPE, FITTINGS, AND VALVES

7.01 Scope: The work covered by this Section of Specifications consists of furnishing all materials and equipment and performing all labor necessary for furnishing and installing interior and exterior piping systems and all other piping systems except those specified under Section Nos. 6 and 14, including all pipe, and appurtenances to the limits shown on the Drawings and/or specified. Requirements for yard piping, beginning 2' outside buildings are specified in Section 14.

7.02 Drawings: The Contractor shall furnish six (6) copies of pipe fabrication details and dimensional layouts for all piping systems for checking and approval by the Engineer. Each joint of pipe and fittings shall be marked and dimensioned to insure proper installation. No fabrication, manufacture, or installation shall commence until such drawings have been approved.

7.03 General: Unless otherwise shown on the Drawings or specified, all interior and exterior piping systems 8" in diameter and larger shall be constructed of ductile iron pipe and ductile iron fittings. No mixture of ductile iron piping and cast iron piping will be allowed without written approval by the Engineer.

7.04 Ductile Iron Pipe: Ductile iron pipe shall conform to Federal Specification WW-P-421c as to general requirements, materials, workmanship and tests, and in accordance with the requirements of AWWA Specification C151-71. Ductile iron pipe 3" through 12" in diameter shall have a 1/8" cement lining, 14" through 24" shall have a 3/16" cement lining, 30" through 48" shall have a 1/4" cement lining and all linings shall have a bituminous seal coat. Piping that is not to be painted shall be coated on the exterior with an approved coal tar coating. Piping to be painted shall not be coated on the exterior, but shall be thoroughly cleaned of all dirt, rust, scale, etc., by sandblasting and shall be painted as specified under the section "Painting". Ductile iron shall be 60-42-10 metal in accordance with ASTM A536-72. Pipe and fittings shall be of ductile iron with ASA standard Class 150 mechanical joints with ductile glands and high strength bolts, bell and spigot, Class 125 ASA flanged as indicated on the drawings and/or as necessary for the use intended. All flanges shall be flat faced. No pipe will be accepted which is less than standard weight by more than 4%. Class designations shall be cast on the pipe and fittings and weights of metal alone shall be painted on the outside. Pipe thicknesses of ductile iron pipe shall be as follows:

Nominal Diameter in Inches	Wall Thickness for Class 150 Ductile Pipe in Inches
8	0.33
10	0.35
12	0.37
14	0.39
16	0.40
18	0.41
20	0.42
24	0.47
30	0.63
36	0.63
42	0.71
48	0.79

(a) Lining: The interior lining for cast ductile iron pipe and fittings shall be spun cement mortar in accordance with AWWA C-104 of latest revision.

(b) Outside Coating: The outside coating for cast ductile iron pipe and fittings shall be a bituminous coating of either coal-tar or asphalt base approximately one mil thick.

(c) Marking Pipe: The weight, class and casting period shall be shown on each pipe. The manufacturer's mark, the year produced and the letter DI shall be cast or stamped on each pipe. All marks shall be clean and legible and all cast marks shall be near the bell.

(d) Certification: The manufacturer of ductile iron pipe shall furnish the Engineer and Owner with certification that the inspection and specified tests have been made and that the results thereof comply with the requirements of ASA A21.51-1971.

(e) Fittings: Fittings for cast ductile iron pipe shall be cement-lined ductile iron. Ductile iron fittings shall meet the requirements of the American Water Works Association Standard C 100-55 of latest revision except as otherwise specified herein.

(f) Outlet Saddles: Outlet or tapping saddles furnished where shown on the Drawings shall be ductile iron 60-45-10 or 80-60-03, furnished with corrosion resistant alloy steel straps meeting the requirements for bolts and nuts in AWWA C111-64. All outlet saddles shall be installed and the pipe tapped prior to shipment by the manufacturer. Outlets may be factory installed by other methods approved by the Engineer.

(g) Cutting Pipe: Ductile iron pipe shall be cut to length by the manufacturer in accordance with his approved schedule. Pipe cuts shall be made only with an approved saw or lathe cutter. The manufacturer may make arrangements with the Contractor for the installation of pipe to make cuts or install saddles or taps in the field at no cost to the Owner.

7.05 Gray Iron Pipe (For Sizes 6-inch and Smaller): Pipe shall be centrifugally cast and shall conform to ANSI Specification A21-6 or A21-8, with push-on type joints and laying lengths of at least 16 feet. Pipe shall be 21/45 iron, Class 21 thickness for 6-inch, maximum depth of cover is 12 feet.

(a) Fittings: Fittings shall be cast from gray iron and shall conform to ANSI Specification A21-10, 1971. Fittings shall have standard mechanical joints and shall be Class 250.

(b) Outlets: Outlets for connections to 6-inch blow-offs shall be made with a boss cast or welded on the pipe, the boss to be faced, drilled and tapped for ANSI Specification B16-1, Class 125, flanged connection. Outlets, size 2-inch and smaller, shall be provided with threads to fit Mueller I.P. thread corporation stops.

(c) Lining and Coating: Pipe and fittings shall be cement-lined inside and bituminous coated outside, in accordance with the applicable provisions of AWWA C-104-74. The inside cement lining shall be treated with a bituminous seal coat.

(d) Weights and Marking: Weights of pipe and fittings shall conform strictly to the requirements of ANSI Specification. The class designations for the various classes of pipe and fittings shall be cast onto fittings in raised numerals, and cast or stamped on the outside of each joint of pipe. Weights shall be plainly and conspicuously painted in white on the outside of each joint of pipe and each fitting after the exterior coating has hardened.

(e) Certification: The manufacturer of iron pipe and fittings shall furnish both the Engineer and the Owner with certified reports stating that inspection and specified tests have been made and that the results thereof comply with the requirements of ASA A21.51 - 1971.

7.06 Interior Pipe and Fittings: Pipe in sizes 2-inch and under shall be copper, sizes 2-1/2 inch to 3-1/2 inch shall be galvanized steel, sizes 4-inch and 6-inch shall be Gray cast iron, sizes 8-inch and over shall be ductile cast iron. Fittings shall be of similar material and class. Details of lining, weight, fitting types and marking shall be as indicated. Sleeves shall be installed at all points where piping passes through walls; such sleeves shall be sealed watertight with a rubber compression seal, OZ, Linkseal or equal. At the Contractor's option sleeves may be either cast iron or fabricated steel 1/4 inch minimum thickness with water stop and seal ring of a design acceptable to the Engineer. Pipe and fittings requiring finish painting shall be sandblasted and shop painted with Koppers 622 primer. The exterior of sleeves shall be unpainted. All fittings shall be short body standard unless otherwise shown.

7.07 Heavy Interior Piping Systems: The Contractor shall furnish and install all heavy interior piping systems, complete, as indicated on the Drawings and specified and/or as required for proper operation of equipment to be installed.

All pipe installed exposed to view inside or outside of buildings shall be painted as specified under the "Painting" section.

(a) Hangers, Supports, and Blocking: Piping systems shall be properly supported by a system of hangers, pipe stanchions, brackets, concrete piers and saddles as required. Inserts, bolts and anchors as required for proper support shall be set into form work or concrete work by the Contractor before any concrete is poured. Pressure lines shall be secured with struts or reaction blocking to prevent any slippage.

(b) Jointing Flanged Connections: Full face gaskets of rubber, with cloth inserts, shall be used. Flanges shall be firmly bolted with machine bolts of the proper size and thread, using a torque wrench for tightening. The bolts and nuts shall be of best quality refined bar iron, with good, true treads, and shall be so tightened as to evenly distribute the stress in the bolts and bring the pipe into uniform alignment.

(c) Jointing Bell-Spigot Connections With Lead Joints: All bell-spigot connections shall be jointed with lead and tubular or molded rubber gasket. The inside of the bell, and the outside of the pipe shall be thoroughly cleaned. Only joint runners in good condition shall be used. Lead joints shall be used only for connections to existing piping and where approved by the Engineer.

(1) Gasket: All lead joints shall be made with best quality tubular or molded rubber gasket, properly installed in accordance with manufacturer's recommendations.

(2) Lead: The lead shall be of the best quality virgin lead, pure and soft and suitable for caulking. The depth of lead joint shall not be leas than 2 inches and, in all cases, must be poured to the full depth of the lead groove. The melting pot shall be kept near the joint to be poured and not more than one pouring shall be made for each joint. Dross shall not be allowed to accumulate in the melting pot. The joints shall be thoroughly caulked by competent mechanics, in such a manner as to secure a tight joint without overstraining the iron in the bells.

(3) Defective Joints: All defective joints shall be melted out and replaced to the satisfaction of the Engineer.

(d) Cutting: Whenever pipe or special castings are required to be cut, the cutting shall be done by skilled workmen, using a Wach saw.

7.08 Operating Piping Systems: The Contractor shall furnish and install all small operating and control piping systems indicated on the Drawings and/or as required under these Specifications.

(a) Materials: Piping for all water lines smaller than 3 inches in diameter and all operating and control piping systems, including pneumatic supply and control piping systems, shall be of hard drawn copper except where otherwise specified herein. Copper pipe, copper fittings and joints and valves shall be as follows:

(1) Copper Pipe: Pipe sizes specified are nominal internal diameters. All exposed pipe except where otherwise specified, shall be of hard drawn rigid copper pipe. Pipe installed in ducts or within equipment cabinets may be of soft drawn copper. All such soft drawn copper shall be stretched after being uncoiled and before being installed. No piping smaller than 1/4 nominal internal diameter shall be used. In general, copper pipe 1" and smaller shall be Type L weight and thickness and pipe 1-1/4" and larger shall be Type M weight and thickness. All copper pipe for pneumatic and water pressure over 150 psig shall be Type K, weight and thickness.

(2) Copper Fittings and Joints: Copper fittings shall be of the cast pattern or the wrought pattern with only one pattern type being used in the installation. The mixing of cast and wrought pattern fittings will not be permitted. Fittings for rigid copper pipe shall be of the solder joint type. Fittings for concealed soft drawn pipe may be of the flared mechanical type. Unions shall be of the ground joint type with a union installed at every point of piping connection to a machine, pieces of equipment, or fixture which may require disconnecting for service or maintenance. All pipe ends shall be cut square and burred internally and externally before insertion in fitting socket. All pipe ends shall be sanded clean and all fittings sockets shall be wire brush cleaned to insure 100% tinning of the socket and pipe joint surfaces and to insure full solder penetration of the joint. No acid or acid base solder flux shall be used for surface cleaning. The solder bead at the external pipe to socket joint shall be "wiped" with a dry cloth while the solder is still molten. 95-5 solder shall be used for all air lines.

(3) Valves: Valves shall be solder end, check, gate or globe pattern as specified or indicated on the Drawings. For air, globe and check valves shall have composition disc for tight shut-off. All valves shall be 125 lbs. WWP design. Valves for gauges where required shall be union gauge cocks with pipe threaded to copper

adaptors. Special valves for special services shall be as specified elsewhere herein.

(b) Painting of Operating and Control Piping Systems: Operating and control piping systems shall be cleaned and painted as specified under the "Painting" section.

(c) Installation and Arrangement: All pipe runs shall be parallel with or at right angles to walls, ceilings, equipment, etc. 45° fittings or angle runs shall be avoided as far as possible. Piping shall be neatly arranged and installed, such that it both meets the service requirements and leaves the machine or equipment it is serving accessible. Insofar as possible; all valves shall be installed accessible for operation by a man standing on the operating floor.

(1) Installation on Grade: All piping whose service requires draining of moisture shall be installed with the required slope in the proper direction for gravity drainage.

(2) Parallel Runs: All parallel runs of piping shall be installed with equidistant spaces between the piping and shall be neatly grouped. Grouping shall be such that cross-overs, except at branches, are avoided.

(3) Arrangement Drawings: Where required by the Engineer, the Contractor shall prepare a detailed piping arrangement drawings to not less than 1" equals 1' scale, showing location and arrangement of all piping connections, unions, fittings, valves, hangers or supports This shall be approved by the Engineer before the Contractor proceeds with the actual installation.

(d) Hangers and Supports: The maximum distance between hangers or supports shall not exceed:

1/4" and 3/8" diameter - 4'
1/2" diameter - 6'
3/4" and 1" diameter - 8'
1-1/4" to 2" diameter - 10'
2-1/2" diameter & Larger - 12'

Piping, 1" and smaller, shall not be hung from rod hangers. Rod hangers, where used, for pipe 1-1/4" and larger shall be split pattern. No pipe shall be clamped directly to a masonry surface. Steel brackets shall be used such that there will be a space, not less than 1" between the pipe and any masonry. Piping, 1" and smaller, and preferably piping 1-1/4" and larger, shall be clamped to brackets or other steel members with clamps which will allow no axial movement. Clamps and clamping arrangements shall be of the "Unistrut" type, properly supported from fabricated steel brackets, beams, etc., to provide the required maximum support distance for the diameter of pipe, drainage slope, arrangements, and grouping required.

(e) Hydraulic Operating Pipe: Hydraulic operating pipe shall be of sufficient size for proper operation of equipment, and unless otherwise specified lateral size shall in no case be smaller than equipment connection size. As specified above, unions and valves shall be installed at each point of connection to equipment.

(f) Pneumatic Supply and Control Piping Systems: Piping for pneumatic supply systems including main supply headers and supply laterals shall be of the size and in locations indicated on the schematic drawings and/or as necessary for proper operation of the equipment.

Such headers and laterals shall be run on upward and/or downward grades with filters and automatic operated separators at points shown on the schematic drawings and as directed by the Engineer. Headers and laterals on air supply directly from receiver shall be run on upward and/or downward grade with drip legs and automatic drain traps or separators at all low points. Small supply laterals from main supply headers and laterals shown on the schematic drawings to each instrument or control user shall be 3/8" O.D. Copper. Air sets consisting of drip leg, regulator and pressure gauge shall be furnished for each shipment or control user by the manufacturer of such instrument or control user and shall be mounted as close to said instrument or control user as is possible. Pneumatic control or signal piping shall be sized for proper operation, but not less than 1/4" O.D. copper. Pneumatic lines installed in conduit or inside control cabinets shall be "Poly-Flo" tubing as manufactured by Imperial-Eastman Corp.

7.09 Galvanized and Iron Pipe: Galvanized iron pipe shall be of the size shown, galvanized, threaded and in accordance with ASTM A53-68, except nickle content shall be 1.60% to 2.20% and copper content shall be 0.75% to 1.25%. Specifications for trenching and laying shall conform to those given herein for cast iron pipe.

7.10 Wall Sleeves: Where cast iron piping connects with or passes through concrete walls, furnish and install cast iron wall sleeves suitable for Link Seal or mechanical joint. Formed openings in concrete walls for inserting cast iron piping will not be allowed. Wall sleeves shall be accurately located and securely fastened in place before concrete is poured. In a similar manner, wall pipes shall be used in locations where small piping and electric wiring connects with or passes through concrete walls.

In lieu of cast iron sleeves the Contractor, at his option, may install steel sleeves of 1/4" minimum thickness with exterior water stop ring at least 4" high welded continuous around the center of the sleeve. The interior and exterior of the steel sleeves shall have a near white blast in accordance with SSPC-SP10. The end of the steel sleeves shall be beveled or rounded and the interior surfaces shall be cleaned and painted as specified under the section "Painting". The I.D. of the steel sleeves shall be 2" more than the O.D. of the Pipe installed in the sleeves. The space between the pipe and the sleeve shall be sealed at each end with Link Seal units as manufactured by Thunderline Corporation. Materials of construction of the link seal units shall be as recommended by the manufacturer. All bolts and metal parts shall be cadmium-plated.

7.11 Chemical Feed Piping: All chlorine gas piping and chemical solution piping inside of buildings shall be Schedule 80 PVC with screwed, welded or flanged connections as shown on the Drawings or as directed by the Engineer, except where specifically designated to be Saran lined steel piping. All chlorine gas piping and chemical solution piping installed underground or where noted on the Drawings shall be Saran lined Schedule 40 steel pipe with flanged connections. Expansion joints shall be provided in all PVC at intervals of not more than 100 feet. PVC unions shall be installed at connections to each valve, at each item of equipment; at each fitting, and at locations designated in the field for removal of short pieces of the line for inspection purposes. In general PVC piping shall be run and supported in the same manner as specified for control piping in Paragraph 7.08, except spacing hangers shall be as recommended by the piping manufacturer and as approved by the Engineer. All chlorine gas valves and all chemical solution valves shall be furnished by the chemical feed equipment manufacturer, as well as automatic and manual control valves for use in controlling water supply to chemical feed or application equipment.

7.12 Restrained Joint Pipe: Restrained joint pipe shall be of ductile iron and of the thickness previously specified. Restrained joint shall be "Lox-Tyton" or "Lok Tyte" as manufactured by United States Pipe and Foundry Company, or "Lok-Fast" as manufactured by American Cast Iron Pipe Company.

7.13 Manual Operated Interior Valves: Interior gate valves, ball valves, butterfly valves and geared plug valves shall be furnished with handwheel operators. Plug valves without geared operators shall be furnished with lever operators. Valves operated from operating floors above the valve shall be equipped with extension stems, operating nut and cast iron floor box or floor stand or with extension bonnets to 3'-0" above operating floor as shown on the Drawings. Furnish geared chain wheel operators for valves located more than 5'-0" above the operating floor.

Gate valves 12 inches and smaller, on suction of pumps, for vertical or horizontal installation shall be O.S. & Y. with handwheel. Gate valves 12 inches and smaller on discharge of pumps for vertical installation shall be double square bottom, O.S. & Y. with handwheel. Gate valves larger than 12 inches on suction of pumps for vertical installation shall be O.S. & Y. with spur or bevel gearing and handwheel. Gate valves larger than 12 inches on discharge of pumps for vertical installation shall be double square bottom, O.S. & Y., with by-pass, spur or bevel gearing and handwheel. Gate valves larger than 12 inches on discharge of pumps for horizontal installation shall be double square bottom with tracks, trunnions and scrapers, O.S. & Y., with by-pass, spur or bevel gearing and handwheel.

All interior gate valves size 12 inches and smaller shall be for 175 psi service. All interior gate valves, sizes larger than 12 inches shall be for 150 psi service. All interior plug valves shall be for 125 psi service. All interior low pressure butterfly valves, except filter valves, shall be Class 25-8 with operator designed for 50 psi service. All interior high pressure valve shall be Class 125-8, with operator designed for 150 psi service.

7.14 Filter Valves: Filter valves shall be butterfly type, hydraulic operated. Operation will be with two (2) three way solenoid valves per operator. Valve position shall be indicated with open and close limit switches. Filter influent valve shall have extension stem and floor stand. Filter wash water valves and operators shall be Class 50-8 with external adjustable threaded stop. Filter sweep valves shall be hydraulic operated gate valves, solenoid actuated. All other valves shall be Class 25-8 with operator designed for 50 psi shut-off.

7.15 Butterfly Valves: All butterfly valves for pipe line or outside pressure pipe service shall be of the tight closing rubber seat type and shall be furnished as manufactured by Henry Pratt, Darling, Allis-Chalmers, or approved equal. All valves shall comply with AWWA Specification C504-74. All valves 16-inch and larger shall be butterfly valves unless shown or specified otherwise and shall meet the following requirements:

(a) Class: Yard piping valves for low pressure service shall be Class 25, designed for 16 fps velocity. High pressure valves shall be Class 150 designed for 16 fps velocity.

(b) Valve Construction: Valve construction shall be as follows:

(1) Valve Body: Valve bodies shall be of cast iron, ASTM A-126, Class B, or ASTM A 48, Class 40 with mechanical joint or prestressed pipe ends.

(2) Valve Shafts: Valve shafts shall be 18-8, Type 304 stainless steel.

(3) Valve Discs: Valve discs shall be cast iron ASTM A-126, Class B or ASTM A 48, Class 40 with 18-8 Type 316 stainless steel seating edges, or ASTM A-436 Type 1, Stainless Cast Iron. If the rubber seat is on the disc then the body seat shall be 18-8, type 316 stainless steel.

(4) Valve Seats: Valve seats shall be of hycar or natural rubber. Performance tests required in Section 12 of AWWA Specification C504-74 which refer to performance and leakage tests shall be performed and certified by the manufacturer.

(c) Manual Valve Operators: Manual valve operators shall be totally enclosed worm gears suitable for burried service or with extended bonnet suitable for outdoor service as shown on the plans and in accordance with AWWA C 504-74.

Valves equipped with extension bonnets shall be mounted with shaft in a vertical position with extension stem enclosed in a pipe extension bolted to the valve operator flange and furnished with operator at 3' - 0" above grade or operating floor level.

Valves mounted in a horizontal position with extension stems shall have the gear operator mounted on the valve with extension stem and operating nut and valve box or floor box installed at grade or operating floor, or with floor stand as shown on the drawings.

(d) Cylinder Operators: Cylinder operators shall move the valve to any position from fully open to fully closed with a maximum water pressure of 150 psi or a minimum water pressure of 50 psi applied to the cylinder. The cylinders shall be suitable for air, oil and water, and shall conform to AWWA Specification C-504-74. The operating mechanism shall be of the rigid or swivel cylinder type, with speed control valves, local indicator, adjustable stops, and open and closed limit switches. Operation shall be with one (1) four way solenoid valves per operator, ASCO No. 8344 or approved equal.

(e) Valve Testing: Hydrostatic and leakage tests shall be conducted in strict accordance with AWWA C504-74 Section 13.

(f) Affidavit of Compliance: The manufacturer shall, upon completion of manufacture, provide to the Owner an "Affidavit of Compliance" in accordance with Section 18 of AWWA C504-74.

(g) Proof of Design Test: The manufacturer shall include with his submittal certified copies of Proof-of-Design tests in accord with Section 13.4 of AWWA C504-74.

(h) Painting: Interior and exterior of valves shall be painted in complete accordance with the Section "Painting".

7.16 Plug Valves: The Contractor shall furnish and install all plug valves complete, with all accessory equipment as specified and/or as shown on the Drawings.

(a) Manufacture: All plug valves and plug valve accessories shall be as manufactured by DeZurik, Homestead or approved equal.

(b) General Construction: All plug valves shall be of the non-lubricated, eccentric type with resilient faced plugs, and screwed, flanged, or mechanical joint ends as shown on the plans. Port areas of 4" - 12"

valves shall be at least 92% of full pipe area. Bodies shall be semi-steel with raised seats. Seats in 3" and larger valves shall have a welded-in overlay of not less than 90% pure nickel or epoxy coating on all surfaces contacting the plug face. Valves through 20" shall have stainless steel permanently lubricated upper and lower plug stel bushings. Valves 24" and larger shall have stainless steel upper and lower plug stem valves and bronze bushings. Stem bushings with "O" rings are not acceptable on any size. All valves 4" and larger shall be of the bolted bonnet design. All valves shall be designed so that they can be repacked without removing bonnet from valve. Packing on all valves shall be adjustable. All exposed nuts, bolts, springs and washers shall be stainless steel. Means of actuation shall be by lever, gear actuator, tee-wrench, extension stem, floor stand, etc., as indicated on the plans. Flanged valves shall be faced and drilled to ASA 125# standard. Flanges of valves through 12" shall have face to face dimensions of standard gate valves.

(c) Gear Actuators: All manually operated valves larger than 12" shall be equipped with gear actuators. All gearing shall be enclosed suitable for running in oil with seals provided on all shafts to prevent entry of dirt and water into the actuator. Gear cases shall be filled with EP #90 gear oil lubricant before shipment from factory: G6 gears---one (1) quart, G12 gears---8 quarts, G16 gears---24½ quarts. Valves shall be checked on job site to be sure lubricant is in gear housing. All shaft bearings shall be furnished with permanently lubricated bronze bearing bushings. Actuator shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque. Valve packing adjustment on non-submerged valves shall be accessible without removing the actuator from valve. Construction of actuator housing shall be semi-steel. All exposed nuts, bolts, washers shall be stainless steel.

Valves and actuators for submerged or buried service shall have seals on all shafts, and gaskets on valve and actuator covers, to prevent the entry of water. Actuator mounting brackets for submerged service shall be totally enclosed and shall have gasket seals.

Gear actuators shall be of the type that can be mounted for remote operation and high head extension, waterproof, enclosure pipe.

All manually operated buried valves shall be furnished with heavy duty two piece cast iron valve boxes. The valves boxes shall be adjustable to 5" up and down from nominal length. Extension stem shall be installed inside of the valve boxes with operating nuts to within six inches of finish grade.

(d) Cylinder Actuated Valves: Cylinder operated plug valves shall be equipped with double-acting hydraulic cylinder actuators capable of operating the valve at a minimum cylinder pressure of 50 psi and shall be capable of withstanding a cylinder pressure of 150 psi. Operation shall be with 2 three way solenoid valves per operator. Actuators shall be DeZurik, Homestead or approved equal. Actuators shall be rack and gear type, and shall be enclosed suitable for running in oil with seals provided on all shafts to prevent entry of dirt and water into the actuator. Gear cases shall be filled with EP#90 gear oil lubricant before shipment from factory: G6 gears---one quart, G12 gears--- 8 quarts, G16 gears --- 24-1/2 quarts. Valves will be checked on jobsite to be

sure lubricant is in gear housing. All shaft bearings shall be furnished with permanently lubricated bronze bearing bushings. Actuator shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque. Valve packing adjustment on non-submerged valves shall be accessible without removing the actuator from the valve. Construction of actuator housing shall be semi-steel. All exposed nuts, bolts and washers shall be zinc plated. Actuators shall be equipped with mechanical means to isolate cylinder from gear operator so that valve can be operated through gear housed operator only. This shall be done without disconnecting air to hydraulic supply lines.

(e) Painting: The interior and exterior of all plug valves, shall be painted in complete accordance with the "Painting" section.

7.17 Standard Gate Valves: The Contractor shall furnish and install all gate valves as indicated on the Drawings, and specified herein. Gate valves size 2-inch and larger shall conform, in general, with the latest specifications of the American Water Works Association, Designation C500-71, shall be equipped with "O" ring packing, and shall be as follows:

(a) General Construction: Gate valves shall embody the best class of workmanship and finish, and shall open and close freely and easily. In closing the gates shall move to their position opposite the ports, both discs being then closed squarely against the seat rings. With discs raised, each valve shall have a clear water way of the full nominal diameter of the valve. All wearing and bearing faces shall be suitably proportioned, and all working parts shall be of bronze, or bronze mounted. The seats and face rings for the valve discs shall be of satisfactory dimensions, according to the best shop practice, and the seat rings shall be faced in a lathe, to a true and even surface, so as to form a watertight joint when drawn together; and if such joint cannot be produced by machine work, then the faces shall be dressed, and with disc ground to its own true bearing without the aid of templates. Such face rings shall be securely screwed into the recess made thereon in the valve case.

The face rings of the discs shall be machined, dovetailed or driven into corresponding machined grooves in the disc of gates and rivets on with suitable non-corrodible metal rivets. All stems shall be forged bronze stems.

(b) Working Pressure: Gate valves 12 inches and smaller shall be furnished for 175 psi, water working pressure. Gate valves larger than 12" shall be furnished for 150 psi, water working pressure.

(c) Operation: All valves shall open left. Valves shall be operated by hand wheel or operating nut as indicated on the Drawings. Operating nuts shall conform to present city standard, and shall have an arrow cast on them, indicating the direction for opening the valve.

(d) Marking: Each valve shall be plainly marked with the manufacturer's name or particular mark, the year of manufacture, the size of the valve, and designation indicating working pressure, all cast on the bonnet or body.

(e) Installation: Gate valves 12 inches and smaller shall be furnished for vertical installation, N.R.S., with handwheel or operating nut as

indicated on the Drawings. Gate valves larger than 12 inches shall be furnished, double square bottom for horizontal installation with extended bevel gears, grease case, tracks, trunnions and scrapers, by-pass.

(f) Testing: All gate valves shall be tested in accordance with American Water Works Association Standards.

(g) Jointing: All gate valves, unless otherwise indicated on the Drawings or necessary to join to existing work, shall be furnished with mechanical joints, and necessary bolts, glands and gaskets or flanged 125# ASA standard.

(h) Valve Boxes: All buried gate valves and by-passes shall be equipped with valve boxes. Valve boxes shall be heavy roadway type. The valve boxes shall be cast iron two-piece screw type with drop covers. The valve boxes shall be adjustable to 5" up or down from the nominal required cover over the pipe. Extension stems shall be installed inside the valve boxes with operating nuts to within 6" of finished grade.

(i) Painting: Interior and exterior of gate valves and appurtenances shall be painted in accordance with the section "Painting".

7.18 Electric Motor Operators: All electric motor operated valves shall have a valve mounted gear reducer, with enclosed drive shaft bolted to gear reducer and extending to pedestal mounted motor operator, or extended bonnet mounted gear reducer and motor operator as shown on the drawings.

(a) Operating Unit: The motor operated valve control shall include the motor, operator unit gearing, limit switch gearing, limit switches, torque switches, stem nut for rising stem valve or bored and keywayed drive sleeve for non-rising stem valves, de-clutch lever and auxiliary operating nut as a self-contained unit. The valve operator shall be mounted on a fabricated steel or cast iron pedestal of substantial proportions, with ample base area to evenly distribute the load to the supporting structure. All motor operated valves shall have a fabricated steel or cast iron control cabinet fastened to the pedestal. The control cabinet to be weatherproof construction and contain reversing controller, valve position transmitter, three push buttons, three indicating lights, fused disconnect switch, control power transformer, space heater, and necessary wiring. Control cabinet door shall be so constructed that door cannot be opened without moving disconnect switch to "OFF" position.

(b) Motor: The motor shall be specifically designed for valve operator service and shall be of high torque totally enclosed, non-ventilated construction.

The motor shall be of sufficient size to open or close the valve against maximum differential pressure when voltage to motor terminals is 10% of nominal voltage.

The motor shall be pre-lubricated and all bearings shall be of the anti-friction type.

(c) Operating Unit Gearing: The power gearing shall consist of generated helical gears of heat treated steel and worm gearing. The worm shall be of carburized and hardened alloy steel with the threads ground

and polished after heat treating. The worm gear shall be of chilled nickel bronze accurately cut with a hobbing machine. All power gearing shall be grease lubricated. Ball or roller bearings shall be used throughout. Preference will be given to units having a minimum number of gears and moving parts.

(d) Gear Limit Switches and Limit Switch Gearing: Limit switches and gearing shall be an integral part of the valve control. The limit switch gearing shall be of the intermittent type, totally enclosed, grease lubricated to prevent dirt and foreign matter from entering the gear train and shall be made of bronze. Limit switches shall be of the adjustable type capable of being adjusted to trip at any point between fully opened valve and fully closed valve.

Each valve control shall be provided with a minimum of two rotor type gear limit switches, one for opening and one for closing. The rotor type gear limit switch will have two normally open and two normally closed contacts per rotor. Gear limit switches must be geared to the driving mechanism and in steps at all times whether in motor or manual operation.

(e) Torque Switches: Each valve control will be equipped with a double torque switch. The torque switch will be adjustable and will be responsive to load encountered in either direction of travel. It shall operate during the complete cycle without auxiliary relays or devices to protect the valve should excessive load be met by obstructions in either direction of travel.

(f) Manual Operation: A 2" square operating nut shall be provided for manual operation. The operating nut shall not rotate during electric operation, but must be responsive to manual operation at all times except when being electrically operated. The motor shall not rotate during hand operation nor shall a fused motor prevent manual operation. When in manual operating position, the unit will remain in this position until motor is energized at which time the valve operator will automatically return to electric operation and shall remain in motor position until operating nut operation is desired. This movement from motor operation to operating nut operation shall be accomplished by a positive de-clutching level which will disengage the motor and motor gearing mechanically but not electrically. Hand operation must be reasonably fast. It shall be impossible to place the unit in manual operation when the motor is running.

(g) Limit Switch Compartment: The gear limit switches and torque switches shall be housed in a single, easily accessible compartment integral with the power compartment of the valve control. All wiring shall be accessible through this compartment.

(h) Reversing Controller: A NEMA rated motor controller in suitable enclosure is to be provided for each valve operator. Each opening and closing contactor is to be provided with auxiliary contacts and the two contactors shall be mechanically interlocked. The three main poles are to be provided with barriers and means of extinguishing the arcs. Overload relays are to be provided in at least two phases of the polyphase motor.

(i) Hammer Blow Device: The valve control shall have a built in lost motion device that travels a minimum of 135° before imparting a hammer blow to shut valve in motion in either the opening or closing direction. This lost motion device also must permit motor to attain full speed before load is encountered. This lost motion device is not to be provided for those valves used in inching, throttling, regulating or modulating service or on the butterfly valves.

(j) Local Control Station: All motor operated valves proposed and existing shall have a local control station, selector switch and cycle timer to be furnished and installed in this contract. The station shall consist of three push buttons marked "OPEN", "STOP", "CLOSE", with three indicating lights controlled by the gear limit switch and a position indicator. A red light is to be on when valve is fully closed and a green light is to be on when valve is fully open. Both lights are to be on when the valve is in any intermediate position and an amber light is to flash while the valve disc is moving.

(k) Wiring: All internal wiring of the electric motor operators shall be in accordance with the City of Athens standard wiring diagrams. The Contractor shall furnish and install all electrical control devices, control cable, wiring, and conduit as necessary for operation of the valves and as shown on the drawings.

7.19 Swing Check Valves: Swing check valves for small piping shall be brass or bronze single disc type. Check valve 3" in diameter and larger shall be IBBM with outside lever and spring as manufactured by Ludlow-Rensselaer, M & H Valve & Fitting Co., or approved equivalent.

(a) Painting: The interior and exterior of the check valves shall be painted as specified under the section "Painting".

7.20. Testing: When a section of pipe of a length deemed adequate by the Engineer is ready for testing, the line shall be thoroughly blown free from air and a leakage test made, and the Contractor shall furnish all labor, materials and equipment for carrying out these tests. All joints then shall be examined during test and all leaks entirely stopped. The Contractor shall furnish a test pump and means for accurate measurement of water introduced into the line during testing.

(a) Temporary Bulkheads: The Contractor shall furnish, install and remove all temporary bulkheads, flanges or plugs, to permit the required pressure tests, and shall furnish all equipment and labor to properly carry out such tests and to replace defective material.

(b) Test Pressure and Leakages: Test pressures shall be 50 psi for low pressure piping and 200 psi for high pressure piping. Leakage shall not exceed 5 gallons per inch of diameter per mile per 24 hours after all visible leaks have been repaired. However, if in the opinion of the Engineer additional testing is required, such additional testing shall be performed by the Contractor at no additional expense to the Owner.

(c) Defective Materials and Workmanship: Any cracked or broken material, such as pipe, fittings, valves or hydrants shall be removed and replaced with sound pieces, at the expense of the Contractor. Joints which leak shall be carefully remade. Remade joints and replaced material shall be

retested under the same conditions of operations. If joints or materials are then found to be defective, they shall be remade and replaced until the line passes the required test.

7.21 Valve Boxes: Valve boxes shall be heavy roadway type cast iron two piece slide type with drop covers. The word "Water" or "Sewer" shall be cast in raised letters on the cover, depending on service. Valves boxes shall be adjustable up or down. Valve boxes for interior serivce shall be floor boxes, Clow F-5690.

7.22 Yard Hydrants: Yard hydrants shall be 2" as manufactured by American-Darling Valve or approved equal.

7.23 Small Pipe and Valves: Pipe smaller than 4-inches shall be copper or galvanized steel, with threaded joints, Schedule 80 as specified in 7.08. Valves shall be 150 psi, brass globe and angle valves with plug type disc.

7.24 Cleaning Up: Before any estimate for partial payment is approved, all broken pavement, all material not used, and rubbish of every character must be removed from the location of that section on which the partial payment is being requested. The Contractor shall arrange for disposal site, and shall haul and dispose of all waste materials at no additional cost to the Owner. The condition of the location of the work must meet the approval of the Owner and the Engineer. Before the work shall be considered complete, all broken pavement, all material not used, and rubbish of every character must be removed from the locations of the work, and all streets, sidewalks, curbs, fences, and other private or public facilities and structures disturbed must be in essentially as good condition as existed before the work was done. Any subsequent settlement of backfill over trenches shall be refilled and the surfaces brought to grade.

7.25 Payment: No separate payment will be made for work under this Section of the Specifications, except as set forth in the Proposal in "Extra Work, if Ordered by the Engineer". The cost of such work and all costs incidental thereto shall be included in the price bid for the item to which the work pertains.

SECTION NO. 8

SUPERSTRUCTURES AND MISCELLANEOUS EQUIPMENT

8.01 Scope: The following Specifications cover materials and work to be done for all buildings.

8.02 Roofing insulation, cants, flashing, counterflashing, and guarantee shall be as follows:

(a) Roofing shall be built-up twenty-year bond, Celotex Corp. Co. 340C, Bird & Son, Inc., No. C-BB-3-15R, GAF Corporation 203-A, or approved equal, and shall be installed by experienced roofers in strict accordance with the manufacturer's specifications for roofing on concrete slab, insulated deck.

(b) One and one-half (1-1/2") inch fiberboard insulation shall be laid over new roof decks. The insulation shall be bonded to both the deck and the roofing. MAX C = .24.

(c) Cants shall be provided for the roof. The cants shall be of lightweight concrete, and of the dimensions indicated on the drawings.

(d) Flashing shall be installed in accordance with the roofing manufacturer's standard specifications; run up the wall and bonded to the brickwork and/or as indicated on the drawings. Counterflashing shall be 16 oz. copper installed in a manner which will insure weathertightness, and in accord with the details indicated on the drawings. Spandrel flashing shall be 16 oz. copper and installed over doors, windows, spandrel beams and sills.

8.03 Sheet Metal Work. Downspouts shall be installed in the locations indicated on the drawings, and shall be fabricated from 16 oz. sheet copper. Scupper, conductor head, and conductor shall be fabricated from 16 oz. sheet copper. Counterflashing shall be 16 oz. copper installed in accordance with Paragraph 8.02 d. above.

8.04 Laying Insulation and Built-Up Roofing:

(a) Roof and all materials shall be dry. Insulation at least 1-1/2" thick shall be firmly embedded in the hot material used for bonding layers of felt. Lay insulation in parallel courses, stagger joints between blocks, with joints tightly butted. If not covered with roofing immediately, protect from rain at the end of the day's work.

(b) Lay all built-up roofing strictly in accordance with published instructions of the manufacturer of the approved roofing material. See Paragraph 8.02 a. for roofing bond by Contractor's Surety.

(c) Flashing and Gravel Stop. Flashing shall be provided around all parapets and openings in roof, as shown on plans. Provide gravel stops at edges, extending down to cover edge of the roof deck and extending back on roof. Stops shall be crimped 5/8" high to retain the gravel, and securely fastened, then stripped with felt and mopped down. Material shall be 16 oz. copper.

8.05 Brick Concrete Masonry Units and Structural Glazed Tile Units:

(a) Scope: Work under this heading consists of furnishing all material and equipment and performing all labor necessary to properly install all brick, concrete masonry units and structural glazed tile units as shown on the drawings and/or called for in these Specifications.

(b) General:

(1) Requirements of Other Trades: Furnish and install all sheet metal, anchors, miscellaneous metal, wood, blockouts, blocking, backing, etc., where required.

(2) Storage of Materials: Store cement and lime in a manner to afford ready access and to protect from dampness. Concrete masonry units delivered to the site shall be dry enough to comply with the specified limitation for moisture content, and shall be maintained in this condition, prior to laying in the structure, by storing them above the ground and by covering them for protection against wetting. Unprotected units which have been wetted by rain within the preceding seven days shall be considered too wet to use unless otherwise shown by test. Structural glaze tile shall be stored in Weatherproof cover.

(3) Metal Reinforcement delivered to the site and not immediately used in construction shall be placed on supports at least eighteen (18") inches above the ground.

(4) Cutting and Patching: Consult trades in advance and make provisions for installations to avoid cutting and patching. No chases in walls will be permitted.

(c) Samples: Submit the following samples for the Engineer's inspection:

Structural Glazed Tile: All shapes and types in sufficient number to show range of color.

Brick: All shapes and types in sufficient number to show range of color.

Heavyweight Concrete Masonry Units: Types proposed for use.

Samples must be approved by the Engineer before materials are incorporated in buildings.

(d) Materials: Materials shall conform to the following:

(1) Concrete Masonry Units shall be heavy aggregate concrete blocks conforming to A.S.T.M. Specification C-90-75, Grade N-1. Aggregate shall be sand and gravel or crushed stone. All unsuitable blocks shall be rejected. The Contractor shall furnish corner blocks, jamb blocks, units cast to special shape and all other blocks necessary to complete the job. Corner units shall be bullnose where required.

The manufacturer shall certify that all units furnished have been made, cured and dried in accordance with A.S.T.M. Specifications. Written reports of tests conducted by a recognized independent testing laboratory shall be furnished the Engineer. At least 5 units

shall be tested out of every 10,000 units delivered.

(2) Face Brick: Used for exterior where visible, shall be free from warpage, distortion, cracks or other blemishes that would affect appearance in completed work. Brick shall be manufactured size, 3-5/8" x 2-1/4" x 7-5/8" face brick, conforming to ASTM Designation C 216-75a, Grade SW, Type FBS.

(3) Smooth Select Red Face Brick: Shall be used where brick is visible on interior of building. This brick shall be whole, sound, hard, straight and manufactured size 3-5/8" x 2-1/4" x 7-5/8". Brick shall conform to ASTM Designation C-216-75a, SW, or NW, Type FBS, as amended to date.

(4) All Hard Common Brick: Shall be used for the interior courses of building walls which are not visible. This brick shall be whole, sound, hard, straight and standard 2-1/4" brick, uniform in size. Brick shall conform to ASTM Designation C62-75a, Grade SW, as amended to date.

(5) Structural Glazed Tile: Structural glazed tile shall be used for the interior surfaces of walls and partitions as shown on the drawings. Tile shall be select quality, ceramic glazed and smooth unglazed structural full load bearing, face tile. Color shall match existing tile. All units shall conform to the Specifications of the Facing Tile Institute, and shall be of the highest structural and mechanical quality. Shading shall be consistent with manufacturing process and approved samples.

The nominal face sizes of structural facing tile and fittings shall be 5-1/3" x 12", Series 6-T, nominal thicknesses of 2", 4", and 6".

(e) Mortar for Masonry:

(1) Materials:

a. Cement: Use only one brand of Portland or Masonry Cement.

Portland: ASTM Designation C150-74, Type J.

Masonry Cement: ASTM Designation C91-71, Type II.

b. Lime Putty: Mix hydrated lime, conforming to ASTM Designation C207-74 with water to form putty and store with care to prevent evaporation for 24 hours before use.

c. Mortar Sand: ASTM Designation C144-70 (1975). Colorimetric test shall be no darker than standard.

d. Water: Shall be fresh, clean, fit to drink, and free from acid, alkali, sewage or organic matter.

(2) Types: Refer to Tables in ASTM Designation C270-73 as amended to date.

a. Type "S". (Exterior walls and all other 12-inch walls.)

1/2 Part Portland Cement		1 Part Portland Cement
1 Part Masonry Cement	or	1/2 Part Lime Putty
4 Parts Sand (in damp, loose condition)		4 Parts Sand

b. Type "N": (Walls not otherwise specified)

1 part Masonry Cement, Type II

2-1/2 parts Sand (in damp, loose condition)

(3) Mixed: In accordance with ASTM Designation C270-73.

(4) Color: For face work shall be as approved by the Engineer and shall be inorganic mineral oxides, other mortar in general is to be natural color.

(5) Retardants, Accelerators and Waterproofing Admixtures: Will not be permitted except by written approval of the Engineer.

Mortar for exterior brick shall be waterproofed with Truscon Mortite Waterproofing or equal. Proportion waterproofing in accordance with manufacturer's recommendations.

(6) Cores in concrete masonry units, where shown to be filled shall be filled with masonry mortar.

(7) Metal Reinforcement use in concrete masonry wall construction shall conform to applicable provisions of A.S.T.M. Specification for Metal Reinforcement in Reinforced Concrete Construction.

(8) Anchors and Ties: Furnish and install all anchors and ties required, including galvanized dovetail and zinc coated mesh reinforcing for joints.

(f) Laying Brick: Lay no masonry that may be endangered by freezing. If absorption is greater than 12% soak brick for 24 hours and allow surface film of moisture to evaporate before laying.

Lay brick plumb and true to level courses. Walls shall be laid with running bond or stacked similar to existing adjacent buildings. Lay out courses with a story rod and space courses accurately.

Bond shall be plumb. Lay out and adjust so that courses will terminate at corners or openings with not less than 1/3 of a brick.

Where new work is shown to be joined to old, step back for joining. Brickwork may be toothed only when directed. Remove all loose mortar, clean thoroughly and wet face of all work before joining new work to old.

Lay face work in natural color mortar joints, formed with suitable tools. After initial set, tool concave joints in face work. Width shall be approximately 3/8" so as to obtain a height of 8" for three brick courses.

Cut interior wall joints flush and point smooth for painting. Provide anchorage from concrete to brickwork with galvanized dovetail anchors, 14 gauge, every third course, with 24 gauge slots spaced 24 inches on centers.

All cutting and fitting to make connections with other types of work shall be promptly done by the Contractor, and he shall carefully set or build in all wall plates, columns, beams, arches, or other iron work. He shall also carefully build in all electric conduits, wooden grounds and other materials, equipment and fixtures as may be required.

Carefully cover, box and protect all walls and work in bad weather. Place suitable boxing where the work is liable to injury and in the manner directed by the Engineer. Any damaged or unsatisfactory work must be promptly removed and replaced by the Contractor at his expense.

On completion of the building, the Contractor shall clean the faces of all brick walls with dilute muriatic acid and water, carefully applied with a scrubbing brush. Any pointing up or other work necessary to place the walls in first class condition, shall be done by the Contractor at the same time.

The Contractor shall erect a sample panel of brick at least 3' x 4' showing jointing, bond, etc. The sample must be approved by the Engineer before any brickwork on building is laid.

(m) Concrete Masonry Wall Construction:

(1) Workmanship: All masonry walls shall be true and plumb and built to the thickness and to the bond or pattern indicated on the drawings. Where no bond or pattern is indicated the walls shall be laid in straight uniform courses with the units in the course above regularly breaking joints with the course below. All workmanship shall be of the highest grade.

(2) Sample Panel: Contractor shall erect on the site of the project, where it will remain undisturbed until completion of the job, a sample panel 4 ft. by 4 ft. minimum size, using the concrete masonry units, bond, or pattern, and the kind of joints to be employed in the project, including a sample of the treatment to be given - paint or plaster. Upon visual inspection approval of the sample panel subsequent work shall conform to the same.

Concrete masonry units shall not be wetted prior to laying in the structure except upon written approval of the Engineers. At the stoppage of work at any time the top of construction shall be covered to prevent rain from entering the cores of the units.

(3) Reinforcing: Horizontal joints in all concrete block interior and cavity walls shall be reinforced a maximum of every 16". Reinforcing shall be located as directed by the Engineer. Reinforcing shall be "Dur-O-Wall" with 3/16 side bars, or equal.

(4) Mortar Joints: Standard thickness of mortar joints for both horizontal and vertical joints shall be 3/8 inches. Vertical joints shall be shoved tight. Full mortar bedding shall be used in the

construction of concrete masonry columns and pilasters; for all other concrete masonry work, face shell bedding shall be used with complete coverage of face shells. Furrowing shall not be permitted. Mortar joints shall be tooled concave joints.

(5) Brick Veneer facing shall be bonded to concrete masonry backing with galvanized dovetail anchors spaced 16" vertically and 4'-0" horizontally staggered.

(6) Cut openings in concrete block neatly around all wall outlet boxes so that openings are covered by plates.

(n) Caulking as shown on plans and specified shall be delayed as long as practicable. Caulking shall proceed in the following order: An approved priming material shall be applied to the content surface. Caulking shall then be placed in an acceptable manner. Before application of paint finish all caulking material shall be covered with an approved priming material.

(o) Protection: Properly protect masonry from all damage, including frost action and rain by use of strong waterproof membrane.

(p) Pointing, Cleaning, Etc.: On completion of work, point up and clean exposed masonry, using acid solution, 5% muriatic, and stiff fiber brushes. Before and after cleaning, masonry shall be thoroughly rinsed with clean water.

8.06 Precast Concrete Trim: Precast concrete trim shall consist of sills, coping blocks as shown on the drawings. The mix shall be 1:2:4 using six bags of white Portland cement per cubic yard. Materials shall be as specified under Section No. 3. Precast concrete shall match the existing work.

Beds and joints shall be full and square the full depth and scored to within 1 inch of the face. Provide holes and sinkages for anchors. Lug sills shall be bedded at the ends only and, after the walls are built, joints under the sills shall be filled and pointed with a light colored elastic pointing compound.

8.07 Structural Glazed Tile: Structural glazed tile shall be used for the interior surfaces of walls and partitions as shown on the drawings. Tile shall be select quality, ceramic glazed and smooth unglazed structural full load bearing, face tile. Color shall match existing tile. All units shall conform to the Specifications of the Facing Tile Institute, and shall be of the highest structural and mechanical quality. Shading shall be consistent with manufacturing process and approved samples.

The nominal face sizes of structural facing tile and fittings shall be 5-1/3" x 12", Series 6-T, nominal thicknesses of 2", 4", and 6".

Shapes shown on the Facing Tile Institute catalog shall be furnished as required by the plans for a complete job. In general all exterior corners, sills, jambs, and lintels shall be bull nosed. Interior corners shall be square. The base course shall be set accurately for vinyl tile, cement or other floor finish as indicated on the plans. Miters shall be furnished as required. Double faced walls or partitions greater than 4" nominal thickness shall be built of two single faced units bonded. Double face nominal 4" partitions may

be constructed either with 2" soaps back to back, or single 4" units in the 6-T series.

Units less than 12" nominal length shall be obtained wherever possible from the manufacturer. Any cutting required at the job shall be performed with a power driver saw in such manner as to provide true and even edges.

All units and shapes shall be laid true to line and with courses level. All joints shall be compactly tooled slightly concave. The design of units shall conform to modular layout with approximate joint thickness of 1/4" for the nominal dimensions given for face size.

Cores may run vertically or horizontally except for lintels which shall be suitable for concrete fill, reinforced as shown on the drawings.

All electric conduit, electric cable, outlet boxes, gas lines, water lines, openings for heating and fan ducts, door frames, anchorages for doors and equipment shall be in place either prior to or during the construction of structural tile facings and partitions. No cutting of tile will be permitted after construction of the facing or partition, except upon specific permission and approval of methods by the Engineer. Lintels shall be precast and allowed to attain their full working strength as required for reinforced concrete before placing in the wall. Facings on the interior of the outside walls shall be constructed with the main body of the wall and suitably tied by means of headers or wall ties. Proper bond to the brick wall shall be made at least at every third course of tile.

The bottom course of tile shall be unglazed where floor tile cove trim is used, except where 3" concrete curbs are provided between the bottom tile course and the floor slab. In this case, the bottom tile course shall be glazed. Furnish glazed base tile for use with ceramic and stone flooring.

As the work progresses tile surfaces shall be cleaned with burlap. At the completion of the work they shall be scrubbed with brush and water. No acid or metal scrapers shall be used in cleaning.

All facing tile units shall be packed in suitable cardboard paper cartons or trays for protection. The utmost care should be taken in unloading, stacking and storing facing tile on the job. Storage shall be under weatherproof cover. The units shall not be removed from cartons or trays until they are placed on the scaffold for installation in the work by the masons.

8.08 Floor Coverings: Floor coverings shall be provided for floors in buildings in accordance with the following:

(a) Quarry Tile: Shall be "Summitville" or approved, extruded, square edge ceramic clay tile conforming to the specifications of the Tile Council of America. Floor tile 6" x 6" x 1/2" shall have abrasive non-slip face, color as selected by the Engineer. There shall be a minimum of variation in the color pattern. Samples shall be submitted to the Engineer for approval. The tile shall be laid in a mortar bed with a nominal thickness of 2". Installation shall be in accordance with the best current practice and the conventional cement mortar method described in the "Tile Handbook".

(b) Resilient Tile:

(1) General:

a. Delivery of Material: Deliver materials in unbroken packages, manufacturers' original labels thereon. Do not open packages or remove labels until Engineer inspects and approves.

b. Temperature of Storage and Work Spaces: Not lower than 70° F. for 48 hours before installation, during installation, and for 48 hours after installation; nor not lower than 50° F. at any time thereafter.

(2) Materials:

a. Submit Samples: Of all materials proposed for use, obtain approval of Engineer before proceeding.

b. Vinyl-Asbestos Tile: Amtico, Flinkote, Johns-Manville, or approved 9 x 9 inch size 1/8-inch thick.

c. Vinyl Base: Amitco, Armstrong, or approved, 4 inches high, 1/8-inch thick, plain black, top-set cove type.

d. Primers, Sealers, Adhesives: Water-Resistant type, made of recommended by floor covering manufacturer.

e. Metal Trim: Type to suit conditions, as indicated or approved, anodized aluminum.

(3) Preparation for Installation:

a. Concrete Slabs: Test for moisture; be sure slabs are thoroughly dry before starting work. Remove grease, oil, dirt, and other foreign substances. Where surfaces are too rough or uneven for a satisfactory installation, underlayment will be provided under work of "Cast-in-Place Concrete".

(4) Installation:

a. Vinyl-Asbestos Tile: Install in accordance with standard specifications of Asphalt & Vinyl-Asbestos Tile Institute, 101 Park Avenue, New York, New York 10017.

b. Other Materials: Install in accordance with manufacturer's printed directions.

c. Methods of Installation:

1. Over Concrete: Install by cementing directly to slab.

2. Base: Cement directly to backing.

(5) Edging Strips: Provide wherever edges of covering are exposed. Secure with screws placed near ends, not more than 8 inches apart between. Use expansion shield, not wood plugs, for securing screws to concrete. Where floor covering terminates at door opening, center strip under door.

(6) Finishing: After floor covering and base have been set sufficiently, wash with neutral cleaner. Apply one coat polymer recommended by floor covering manufacturer. Leave surfaces smooth, clean and free from defects. After floors are finished, traffic shall be kept off until acceptance of buildings, except where absolutely necessary, in which case they shall be properly protected and delivered in satisfactory condition.

(c) Concrete Floors: Shall have no separate cement floor finish but shall be treated with natural colored floor hardener and finished as specified for cement floor finish in Paragraph 4.03 (k) herein.

8.09 Ceilings: Furnish and install suspended ceilings in the office and control room as shown on the drawings. The ceiling shall be supported by hanger rods attached to the existing steel roof joist with wire suspension. Provide appropriate clips, clamps, etc. for attaching hanger rods to "T" bars.

The ceilings shall be removable perforated aluminum panels with sound absorption pads, equivalent to "Acousti-Metal" as manufactured by National Gypsum Company, or equal.

The ceilings shall be snapped onto tee bars suspended from 1-1/2" channels at 4-foot centers. Channel hangers shall be 1/4" diameter rods threaded both ends. Aluminum panels shall be 12" x 24" except for 12" x 12" sections necessary to make up ceilings in odd dimensioned rooms. The panels shall have a white enamel finish. Sound absorption pads above the panel shall be of mineral enclosed in flame proof paper envelopes. A metal grid shall be provided between the aluminum pan and sound absorption pad to provide clearance. An aluminum moulding shall be provided at the junction with walls. Aluminum sections suitable to the Engineer shall be provided to allow panels to fit in ceiling sections which are not in even dimensions. Provide framing and supports for recessed fluorescent fixtures by the use of double tee bars. A layout shall be made in accordance with the manufacturer's recommendations and submitted for approval with complete details of fluorescent fixture supports. Panels shall be removable and shall be cleaned of all soil marks upon completion of erection, using materials supplied by the manufacturer.

8.10 Windows: Steel architectural projected windows shall be furnished and installed in the proposed filter and post chemical building and the superstructure for the existing filters. Aluminum architectural projected windows shall be furnished and installed in the chlorine building, central control room, and office.

(a) Steel window frames shall be fabricated of hot rolled carbon steel sections except weather sections which shall be cold formed. Frames shall be 1/8-inch thick, 1-3/8-inch deep unequal leg channel sections for 5/8-inch masonry embedment.

Muntin bars to be continuous from head to sill and from jamb to jamb and shall be welded securely at intersections. Both windows and ventilators shall be properly squared and welded at the corners in addition to usual riveting. Ventilators shall have continuous double weathering all around and shall be supported on steel arms connected at both ends with 1/4" brass rivets. Brass friction shoes shall be provided and shall be held on proper frictional contact by springs packed in grease-tight housings. Vertical mullions to be flat plates with cold formed interior cover plates.

Hardware shall be of solid bronze and shall consist of locking handle for project out vents and locking handle and keeper or spring latch for project in vents.

Windows are to be bonderized and receive one shop coat of primer.

Screens shall be provided for all windows. These screens shall be made of aluminum insect screen wire 18 x 14 mesh, .0113 gauge, attached to re-wirable rolled frames and furnished by the window manufacturer.

(b) Aluminum windows shall match existing aluminum windows in the control room and as shown on the drawings. Frame members and ventilator sections shall be made of 6063-T5 aluminum and given a satin finish. Frame members shall be at least 2-1/2" deep by 1-1/8" thick. Awning vent members shall be 1-3/32" deep.

All sections shall be one piece with joints mortised, tenoned and riveted. Frames shall be braced with fixed meeting rails between vents.

All vents shall be equipped with non-ferrous sliding members and aluminum alloy balancing arms with "Alclad" finish. Sliding members shall operate on tracks of stainless steel. Make provision for adjustment of all ventilators and for locking awning vents by push button automatic spring catch enclosed in the bottom section. All bolts, nuts and hinge pins shall be made of Monel stainless steel and aluminum. Provide neoprene weather stripping for entire perimeter of vents.

Windows shall be equivalent to Flowertown Aluminum Products Co. windows or other approved custom made type. Minor variations are permissable except that no deviation on provisions for frame reinforcing from jamb to jamb at meeting rails or depth of frame and ventilator members will be acceptable. Awning vents shall be used for windows.

Screens shall be provided for all windows. These screens shall be made of aluminum insect screen wire 18 x 14 mesh, .0113 gauge, attached to re-wirable rolled aluminum frames and furnished by the window manufacturer. The upper screens shall be fixed and the lower screens shall be sliding.

Provide aluminum channel glazing beads for the bottom pane of each ventilator. All multiple windows shall have mullion covers inside and outside. Care shall be taken during installation that windows are set freely without binding, twisting or warping. Wherever aluminum shall come in contact with steel, steel shall be painted with one coat of bituminous asphalt paint prior to the window installation. Window frames shall be wiped with an oily rag before installation to facilitate removal of cement or other particles which may be deposited during construction.

8.11 Glazing, Caulking and Sealing:

(a) All glass for windows and doors shall be of sizes called for on the approved sash and door details. Glass shall be as manufactured by Libbey-Owens-Ford Glass Company, Mississippi Glass Company, Pittsburgh Plate Glass Company, or approved.

(b) Glazing Materials:

(1) Glass for Windows and Exterior Doors: Shall be PPG "Solargray" or "Solarbronze" as selected by the Owner.

(2) Glass for Doors: Unless otherwise noted, scheduled or listed shall be 1/4" thick plate glass, "A" quality, polished both sides.

(3) Wire Glass: Shall be "Polished Baroque" as manufactured by Mississippi Glass Company, or approved. Glass shall be at least 1/4" thick at thinnest point, with standard, welded No. 25 ASW, gauge wire mesh.

(c) Glass: Shall be carefully selected, shall be bedded and face glazed and left clean, sound and free of visible cutting imperfections upon completion of the work. Each light shall bear the identifying label of the manufacturer. In glazing sash, care shall be taken not to bow the bottom of the ventilator. In the event it is bowed during glazing, it shall be pressed back into line before the putty hardens. Glazing beads furnished by the sash manufacturer shall be used for all windows. For installation of the glazing beads, bed the glass in compound, press the beads in place, apply screws and wipe away excess compound.

(d) Caulking and Sealants:

(1) General: Provide and apply all caulking and sealants as required and herein specified.

(2) Caulk or Seal: All openings as shown on the Drawings and all openings which normally required caulking, including but not limited to the following:

a. Joints around windows, door frames or louvers.

b. All joints between metal frame and precast concrete or masonry.

c. Joints between precast concrete panels.

d. Expansion and control joints.

e. All joints between exposed metal and masonry.

f. Joints between stone.

g. Interior joints where indicated or required.

(3) Materials:

a. Sealing Compound for Exterior and Interior Use: Shall be of one part synthetic rubber base sealant or a two component rubber base material. Approved sealants for one part use are PRC-5000, GE Silicone, Tremco's Mono. Approved sealants for two part synthetic rubber base material are Tremco's Dymeric, PRC-250, Sonneborn Sonnelastic Sealant.

b. Joint Backing: Shall be closed cell polyethylene round shape and shall be non-staining, non-absorbent and capable of at least 30% recovery.

c. Material: Shall be delivered to jobsite in sealed container with manufacturer's original labels attached and accompanied by certification of compliance with specifications stored and used in strict accordance with manufacturer's printed instructions.

d. Color of sealants for caulking shall be selected by the Engineer.

(4) Samples: Of all materials and joint backing specified in this Section shall be submitted to Engineer for approval. Manufacturer's current catalog and color samples shall also be submitted.

(5) Workmanship: All sealants shall be applied by skilled applicators having at least 2 years experience. Work shall be of highest quality in compliance with specifications. All joints shall be water and weather tight.

(6) Preparation: All joints shall be clean and free of dirt, oil, grease, moisture, loose mortar or other foreign matter. Metal surfaces shall be wiped with Xylol or MEK and then dried. Masonry surfaces shall be cleaned with wire brush and then bone clean. Any waterproofing treatments contaminating joints shall be completely removed. Joints that are 1/2" wide, shall be packed to 1/2" of the surface. Joints that are 3/4" wide shall be packed to 1/4" of the surface. Size of joint backing shall be large enough so that they can be compressed approximately 30% before inserting into the joint.

(7) Application: Apply sealant with hand gun or air gun under sufficient pressure and through nozzle opening so that a full bead of sealant is running through the joint and fills the opening completely. All beads should be tooled immediately after application to insure firm and full contact with the inner face of the joint.

(8) Cleaning: Remove all excess material and smears adjacent to joint as work progresses.

8.12 Doors: Complete shop drawings shall be furnished by the manufacturer of doors, frames and trim for approval by the Engineers before fabrication or shipment. Doors and frames may be furnished by Williamberg, Overly or Habersham, and shall be furnished in accordance with the following:

(a) Hollow Metal Doors shall be of the flush seamless type. Face of leaves to be constructed of number 16 gauge cold rolled, leveled sheet steel. Face sheets, lock and hinge edges, shall have a smooth, seamless and unbroken surface around the entire girth, with top and bottom edges closed flush to the door face sheets. Lock and hinge edges shall be formed by full overlap of each face sheet around the perimeter vertical channels of a unitized grid structure, meeting at the center line of each edge. The seam shall be closed by a continuous weld, making the outer surface of the door an uninterrupted encasement of steel.

The interior structure of the door shall be a ladder or a grid pattern construction formed of 18 gauge cold rolled steel. The grid shall consist of no less than four continuous vertical members and no less than eight horizontal members. The grid shall be double welded at all junction points and shall have all hardware reinforcements attached by

multiple welds. The grid shall form the top and bottom of the door. The inner surface of face sheets shall be coated with a layer of sound-deadening material prior to assembly. Doors shall be 1-3/4" thick, with lock reinforcement of minimum No. 14 gauge steel. Doors shall be mortised and reinforced for hinges and locks.

(b) Door Hardware Installation shall be mortised, reinforced, drilled and tapped at the factory in accordance with templates or samples to be furnished by the hardware manufacturer.

(c) Frames shall be hollow metal construction, full cold rolled steel, free of scale and defects. Furnish combination buck and jamb frames of not less than 16 gauge steel for swing doors, etc., as indicated on drawings. They shall be mortised, reinforced, drilled and tapped for all hardware. Hinge and strike plate cutouts shall be protected with pressed steel cover plates, spot welded to back or inside of frames opposite these mortises. Frames shall be neatly mitred and all joints welded in their entire length and cleaned to present a smooth surface. Mullions shall be same gauge material as frames and properly welded in place. Angle clips punched for bolts shall be welded to the frames for securing to floor construction. Corrugated steel anchors spaced approximately 24" apart shall be provided for each jamb. Unless otherwise shown on details, trim is to extend to finish floor line.

(d) Special Crane Door for the chlorine room trolley hoist shall be in accordance with the details shown on the Drawings and as specified under Paragraph (a) Hollow Metal Doors. Cut out for trolley hoist rail shall be reinforced and shall have rubber inserts which shall fit snugly around rail when doors are closed.

Door shall be installed where shown, and in strict accord with the approved shop drawings. Horizontal lines shall be level and vertical lines shall be plumb. Anchors and inserts, for guides, brackets, and other items shall be located accurately. Door shall operate freely, and without binding.

Lubricating, cleaning, and protecting of products shall be the responsibility of the Contractor until the Project has been accepted by the Owner. Door shall be lubricated and adjusted to provide smooth operation. Damaged products shall be removed, and replaced with new products, by the Contractor, at no additional expense to the Owner.

(e) Painting: All doors and frames shall be thoroughly cleaned of oil, grease, rust and other impurities at the factory and given two priming coats, baked on separately. The first coat shall be zinc chromate, rust-inhibitive primer. The second coat shall be a combination filler primer for field finishing. Frames of structural channels shall first have all mill scale and rust removed by sandblasting, then given the same finish prescribed for hollow metal doors and frames. Frames shall be finished both inside and out. The shop painting shall be of such quality that no rust shall be apparent through the finish at any time prior to field painting. If rust does appear, the Contractor will be required to remove the factory prime coats which are defective, clean the steel as directed by the Engineer and have new finish applied as specified originally in a manner designed for proper field painting.

8.13 Door Hardware: Hardware shall meet the requirements of Federal Specifications FF-H-00106b dated August 21, 1967, and shall be Government No. 86 Series. Hardware shall be installed in strict accord with the approved shop drawings.

(a) Locksets shall be heavy-duty, mortised, type having US26D finish; Government No. 86-4 Series. Locksets for interior lockable doors shall have "Function 86J". Locksets for exterior lockable doors shall have "Function 86A". Locksets shall be keyed alike. Knob shall be centered 3'-6" above finished floor. Provide strikes and scalps.

(b) Latchsets shall be heavy-duty, mortised type having US26D finish; Government No. 86-4 Series having Function 86N. Knob shall be centered 3'-6" above finished floor. Provide strikes and scalps.

(c) Butts shall be of bronze having a US26D finish, flat button tip, and non-removable pin, and be 4-1/2" x 4-1/2" full mortise type. Butts for door having closer shall be Government No. T2102, and those for doors having no closer shall be Government No. T2122. Top and bottom butts shall be centered no more than 10" from top and bottom of door, respectively. Middle butt shall be equidistant from top and bottom butts.

(d) Closers shall be rectangular, surface-mounted type, having US26D finish; parallel arms shall be provided for closers which will be for reverse-type doors; Government No. 3009. Closers shall be located on the interior side of exterior doors, and on the room side of corridor doors.

(e) Wall-mounted type stops shall have hook-and-eye and resilient tip, be of bronze having US26D finish, and have masonry anchor; Government No. 1321E. Mount eye not more than six (6) inches above the bottom of door, and mount hooks to wall to align with eye. Stops shall be located in line with a vertical line through the center of the cylinder.

(f) Floor-mounted stops shall be dome type, of bronze US26D finish, and have masonry anchor; Government No. 1330AE. Height of stop shall accommodate bottom of door. Stop shall be installed in a position which will preclude the door hardware from striking wall, yet allow the door to be swung to allow passage. Stops shall be located in line with a vertical line through the center of the cylinder.

(g) Silencers shall be of resilient material, and shall be Government No. 1337A. Silencers for single doors shall be mounted in the jamb opposite the butts, and centered with the butts. Silencers for double doors shall be mounted in the head jamb, and in line with a vertical line through the center of the cylinder in the active leaf and the same distance from the edge of the inactive door as is the silencer for the active door.

(h) Flush bolts shall be of bronze having a US26D finish, and be 12" long; Government No. 1046. Bolts shall be installed in top and bottom of inactive leaf of double doors. Provide overhead and threshold strike.

(i) Threshold shall have non-slip top surface, and be of the type shown. Threshold shall be installed where shown, scribed to jamb, and made level and rattle-free.

(j) Weatherstrip shall be of 31 B & S gage bronze spring type, except that sill weatherstrip for doors having "T-3" threshold shall be concealed hook type. Weatherstrip shall be placed on jamb and sill edge of exterior doors.

(k) Astragal for double door shall consist of bronze retainer strip and neoprene seals.

(l) Fasteners shall be for metal doors and frames, and shall be of the size, type, and quantity shown on the approved shop drawings. Finish shall be US26D.

(m) Cleaning and protecting of products shall be the responsibility of the Contractor until the Project has been accepted by the Owner. Damaged products shall be removed and replaced with new products by the Contractor at no additional expense to the Owner.

(n) Hardware Schedule shall be as follows:

Hardware Group No. 1 Door No. 1

2 Pr. Butts (Ea. Leaf)
1 Ea. Lockset - Function 86A
4 Ea. Silencers
1 Ea. Closer w/105° Hold Open (Ea. Leaf)
1 Ea. T & B Flush Bolts (Inactive Leaf)
1 Ea. Threshold T-1

Hardware Group No. 2 Door No. 2, 3, 4, 8, 9

1½ Pr. Butts
1 Ea. Lockset - Function 86A
3 Ea. Silencers
1 Ea. Closer w/105° Hold Open
1 Ea. Threshold T-1
1 Ea. Threshold T-2 (Door No. 8 only)

Hardware Group No. 3 Door No. 10

1½ Pr. Butts
1 Ea. Lockset - Function 86J
3 Ea. Silencers
1 Ea. Closer w/105° Hold Open

Hardware Group No. 4 Door No. 5, 6, 7

1½ Pr. Butts (Ea. Leaf)
1 Ea. Lockset - Function 86A
3 Ea. Silencers
1 Ea. Closer w/105° Hold Open
1 Ea. Threshold T-2
1 Ea. T & B Flush Bolts
1 Ea. Threshold T-1 (Door No. 6 Only)

Hardware Group No. 5 Door No. 12

- 1½ Pr. Butts
- 1 Ea. Latchset - Function 86N
- 3 Ea. Silencers
- 1 Ea. Closer w/105° Hold Open

8.14 Thresholds: Furnish thresholds as shown on the plans for all exterior doors and interior doors as specified above.

8.15 Ladders: Fabricated of 1-1/2" Aluminum pipe rails 24" on centers with 1-1/2 Ø Aluminum Pipe Rungs, as indicated on the Drawings, welded to rails on 12" center.

8.16 Wheel Guards: Type WG9 and WGA as manufactured by McKinley Iron Works or approved equal.

8.17 Roof Scuttles: Furnish and install where indicated on the plans roof schuttle Type S-50 as manufactured by the Bilco Company, New Haven, Connecticut. Cover shall be 11 Ga. with 3" beaded flange, neatly welded. Insulation shall be glass fiber 1" thickness, fully covered and protected by metal liner of 18 Ga. Curb shall be 12" in height and of 11 Ga. It shall be formed with a 3-1/2" flange with holes provided for securing to the roof deck. Curb shall be equipped with an integral metal capflashing of the same gauge and material as the curb, full welded at the corners for absolute weathertightness. Insulation on the exterior of the curb shall be rigid board 1" in thickness. Scuttle shall be completely assembled with heavy pintle hinges, compression spring operators enclosed in telescopic tubes, positive snap latch with turn handles and padlock hasps inside and outside, and neoprene draft seal. Cover shall be equipped with an automatic hold-open arm complete with red vinyl grip handle to permit easy, one handle release. All hardware shall be cadmium plated, and factory finish shall be aluminum lacquer finish.

8.18 Furnishings:

(a) Shades and Blinds:

(1) General:

a. Colors: Selected by Engineer from manufacturer's standard colors; submit samples.

b. Sample Installation: One complete sample installation. Approved sample may be left in place.

c. Workmanship, General: Work fabricated and installed by skilled craftsmen. Do necessary cutting, tapping and drilling. Verify dimensions of finished openings, be responsible for same. Adjust moving parts to operate smoothly without binding. Make further adjustments when required within one (1) year guarantee period.

(2) Venetian Blinds:

a. General: Construct blinds to fit conditions of installation shown on Drawings.

b. Where Required: Provide windows in office and new control room.

c. Install: Under supervision of manufacturer's authorized representative, in accordance with manufacturer's printed direction, and details on the Drawings. Locate controls for convenient operation as directed.

8.19 Hoists: Furnish and install as specified below and as shown on the drawings a hoist complete with runways, rail-beams, anchor bolts, electrification and all other appurtenances necessary. Hoists shall be as manufactured by the Wright Hoist Division of the American Chain and Cable Company, Inc., or approved equal.

The system shall be as follows:

Controls are to be magnetic reversing type, mechanically and electrically interlocked with 115 control circuit. All wiring conforms to applicable NEC and CSA requirements with NEMA Type 3R enclosures.

The motor shall be a standard NEMA flange Class B insulation, 30 minute duty motor with a standard NEMA shaft extension.

Gearing shall be designed for AGMA standards for maximum life, and operate in an oil bath.

Precision heavy-duty ball bearings shall support all shafts and be either splash lubricated, or lifetime pre-lubricated and sealed.

The large diameter steel drum should have deep machined grooves with a depth not less than 0.5 times the rope diameter and a pitch not less than 1.125 times the rope diameter. At least two full turns of rope should remain on the drum at the lowest hook position of rated lift.

Drop forged heat-treated steel hook shall swivel 360 degrees on a shielded roller thrust bearing.

The hoist shall be equipped with two independent braking means:

1. An automatic mechanical load brake with Weston-type multiple disc.

2. An electric motor brake with D-C rectified magnet-actuated disc. Both brakes shall be independently capable of holding a static load equal to 150% of capacity without slipping. The motor brake shall also, be equipped with an interlocking device to prevent the motor from operating against a closed brake or a brake requiring adjustment.

A gravity-type upper hook travel limit switch shall be provided.

A non-friction electro-mechanical overload cutoff device shall be provided that will permit operation of the hoist within its rated capacity, but will prevent lifting of suspended loads which could cause damage to a properly maintained hoist.

Electric Hoist: Hoist shall be a 3-ton capacity, standard headroom, parallel mounted, hoist with 19 foot lift, 15 FPM lifting speed equipped with 3 horsepower, 208 volt, 3 phase, 60 Hertz motor.

Trolley: Trolley shall be 3-ton capacity, 65 FPM single speed motorized trolley capable of operating on a 4'-0" radius curved American Standard I Beam, S 10" x 25.4# or patented track.

Rail: Hoist monorail shall be American Standard I Beam S 10" x 25.4# or equivalent patented track with a right-hand electrified two-way sliding switch.

Electrification: Conductor wiring shall be 100 ampere rating minimum and shall be of the enclosed safety type conductor system, using two 2-conductor channels (fourth conductor connected as ground), and designed to operate the hoist in any position on the rail. All other wiring of the hoist shall be in rigid or flexible conduits and in accordance with the NEC and complying with Fire Underwriter specifications. When the crane is shipped, knocked down, the wiring shall terminate in approved terminal boxes, and wire ends shall be provided with permanent marking tags. Any bending of enclosed safety type conductors shall be done by the manufacturer prior to shipment and such bends shall accurately conform to the required configuration.

8.20 Payment: No separate payment will be made for work under this Section of the Specifications. The cost of such work and all cost incidental thereto shall be included in the prices bid for the item to which the work pertains.

SECTION NO. 9

GENERAL AND DETAILED REQUIREMENTS

GENERAL MECHANICAL WORK

9.01 Scope: This section of specifications covers the general and detailed requirements of mechanical work to be done under this contract.

9.02 Bids on Major Equipment: The Bidder is required to furnish the name of the manufacturer of major items of equipment in the space provided in the proposal in accordance with the following:

(a) Major Equipment: The Bidder shall state in his bid the name of at least one manufacturer or supplier named in these specifications for each major item of equipment listed in the proposal and the bid price for the item. The equipment of manufacturers other than manufacturers named in these specifications will be considered in accordance with the provisions of "Instructions to Bidders and Special Provisions" of these specifications.

(b) Information Required: It shall be the responsibility of the Bidder to ascertain that each manufacturer named in his proposal under the base bid has submitted complete information on the equipment offered in accordance with paragraph (b) (2) following:

(1) Equipment Named in Specifications: For makes of equipment named in the specifications, the above requirements may be satisfied by filling in the proposal the name of the manufacturer of equipment being offered. Any exceptions shall be in accordance with the following paragraph.

(2) Alternate Items of Equipment: For all alternate items of equipment, manufacturers shall submit to the Engineers at least two weeks in advance of the letting any variation in specifications of their equipment. These variations shall be set forth giving complete drawings, specifications and weights of principal parts. If equipment is in strict conformity with specifications and/or plans then a letter or statement to this effect is sufficient. It is desired that only equipment which has undergone thorough development as proved by successful service in similar installations for at least two years shall be accepted for installation under this contract. Equipment which does not have a record of successful service for two years may be accepted at the discretion and upon the terms and conditions set forth by the Engineer. Alternate equipment offered by the Bidder will be checked by the Engineer to assure that the same is equal to equipment named in the specifications in functional design and in mechanical and structural details to be considered for installation in work under this contract.

(c) Service: The manufacturer of the equipment listed below shall furnish the services of a competent factory representative to suspervise and/or inspect the installation and initial operation. The estimated number of days service are as follows:

Equipment Designation	Days of Service
Flocculator Equipment	2
Collector Equipment	2
Chemical Feed Equipment	5
Chlorination Equipment	5
Rate of Flow Control System	2
Monitoring and Control System	2

9.03 Working Drawings: The Contractor's attention is directed to the requirements of the section "Instructions to Bidders and Special Provisions" of these specifications with reference to working drawings. The Contractor shall submix six (6) copies of drawings and details covering the following items of work and such other items of work as may be necessary for successful completion of work under this contract, to the Engineer for checking and approval.

1. Interior Piping Layout, including Control Piping.

2. Instrumentation, Control Equipment, Valving and all other mechanical equipment.

3. Pump settings and piping and necessary accessories.

No fabrication, erection or installation of work listed above shall commence until drawings and details covering such work have been approved by the Engineer.

(a) Check by Contractor: The Contractor shall check all shop drawings and working drawings for accuracy of dimensions and details and for conformation with contract drawings and specifications before submitting such drawings to the Engineer for approval. The Contractor shall indicate that shop and working drawings as outlined above have been checked by him by an appropriate stamp or notation on the face of such drawings.

(b) Responsibility for Accuracy: Approval by the Engineer of the Contractor's working drawings does not relieve the Contractor for accuracy of dimensions and details. The Contractor shall be responsible for agreement and conformity of working drawings with contract drawings and specifications.

9.04 General Specifications for Electric Motors: Electric motors furnished for operating mechanical equipment larger than 1/2 H.P. shall be of General Electric, Westinghouse, or Allis-Chalmers manufacture, 40 degree C rise, Class A insulation or 60 degree C rise, Class B insulation, 1.15 service factor, open, drip proof for indoor installation, 55 degree C rise, totally enclosed, for outdoor installation. All single and three phase motors, except for fan motors which may be of an approved manufacturer's standard, shall be ball bearing, with either sealed in lubricant, or designed for external oil or grease lubrication. Generally, motors of 1/2 H.P. or larger shall be 3 phase, 60 cycle motors, motors less than 1/2 H.P., but larger than 1/4 H.P. shall be single phase capacitor type; smaller motors may be of shaded pole type. All three phase motors shall be 200 volts for full voltage starting.

The manufacturer of major equipment shall be responsible for changes in electrical equipment caused by an increase in horsepower of motors over that specified. Enclosure or phase variations shall be as shown on the drawings or otherwise specified.

9.05 Sterilization: Upon completion of all work, or before placing new work in operation, the Contractor shall sterilize all such work. The Contractor will furnish all necessary Sodium Hypochlorite or liquid chlorine required and the Contractor shall provide all means and labor necessary for sterilization in accordance with the requirements of Section 5 of AWWA Specification D102-64, in accordance with the following, and as directed by the Engineer.

(a) Piping: All new piping carrying filtered water shall be chlorinated by introducing chlorine into the piping systems as the systems are slowly filled. Chlorination of piping shall continue until the indicated residual chlorine concentration within the system is not less than 50 parts per million after 24 hours exposure.

9.06 Operation Adjustments: The Contractor shall, during the thirty-day operating period, make all adjustments to equipment and appurtenances necessary to insure the plant being in first-class operating condition. The Contractor shall, during this period, have competent mechanics available for such work.

9.07 Service: The Contractor shall furnish the services of competent representatives of the manufacturers of the various equipment furnished under this contract, who shall check the installation, initial operation and start up of all such equipment, including the pumping equipment.

9.08 Operation and Repair Manuals: The Contractor shall furnish a minimum of six (6) complete sets of manufacturers operation and repair manuals covering equipment installed under this contract. These manuals shall be submitted to the Engineer not later than 90 days after final approval of the shop drawings.

9.09 Cleaning Up: Before the work is to be considered complete, all material not used and/or rubbish of every character must be removed from the site of the work and disposed of by the Contractor. The construction area and the area around such area shall be left in essentially as good condition as existed before the work was done.

9.10 Sample Pumps: Furnish and install five sample pumps. Each pump shall be constructed with motor and impeller in a common shaft with mechanical seals. Each pump shall be cast iron bronze fitted with enclosed impeller. Pump characteristics shall be as follows:

Description	Finished
Head (ft.)	45
Disch. (GPM)	10
RPM	1750
Min. HP Motor	.75

Pumps shall be sized so that motors are not overloaded more than 5% of any point on the curve. Motor starters and wiring are designed for 1 HP, 3 Ø motors. Sample pumps shall be as manufactured by Allis-Chalmers, Worthington, or Ingersol Rand, suitable for floor mounting.

9.11 Sump Pumps: Furnish and install as shown on plans three (3) automatic sump pumps, each rated to deliver 15 GPM when pumping against 20 feet TDH at 1,150 RPM. Each pump to be complete with grease lubricated radial ball thrust bearing in a cast iron, dust proof housing located well above floor level; cast

iron casing and strainer; before enclosed impeller dynamic balanced and in natural hydraulic balance; enclosed steel hanger pipe; 2" discharge pipe; 2" elbows, steel shaft ground and polished its entire length with bronze grease lubricated intermediate and casing sleeve bearings; float and float switch; all suspended from a cast iron 20" diameter floor plate. Intermediate bearings shall be positioned in bearings plates between two hanger pipe flanges with tongue and groove construction.

Each pump to be directly connected by means of flexible coupling to a 1/4 HP, 3 phase, 60 Hz., 1,150 RPM open drip proof electric motor. Refer to the ELECTRICAL WORK section for voltage.

Pumps shall be designed for sump depths as shown on plans.

Pumps shall be automatically controlled by an integral float switch operating through motor starter control circuit.

9.12 Flocculator Mechanism: The Contractor shall furnish and install mechanical flocculator mechanisms for the flocculation basins complete including revolving mechanisms, stuffing boxes, drive units, drive chains and sprockets, anchor bolts, pressure water lubrication system ans appurtenances, as indicated on the drawings and/or as specified herein.

(a) Revolving Mechanism: The revolving mechanism shall consist of three (3) rows of three (3) 9-foot, 0-inch diameter by 10-foot long rotating paddles, installed at right angles to the flow, with shafts extending through side wall for chain and sprocket drive mechanism, and provided with suitable stuffing boxes. The influent paddles shall rotate at 2 rpm and the second row at 1 rpm. Each paddle assembly shall have a minimum of (2) two structural steel arm supports welded or keyed to the shaft and cross braced to provide a rigid assembly. Paddle arms shall be structural steel angles to which the paddle blades are bolted. Paddle blades may be fabricated from 1/8" steel plate, crimped for strength or 2" heart red wood.

(b) Shafts: The shafts of the flocculator mechanism shall consist of 3-7/16 inch diameter solid cold finish steel. The shaft shall be furnished in convenient lengths and shall be connected with rigid compression coupling, to provide for ease in handling and installation. Shafts shall be supported on concrete pedestals with bearings properly spaced to prevent undue deflection of the shaft.

(c) Underwater Bearings: Underwater bearings shall be cast iron, split, rigid type, with liner and bushings of Ryertex or other approved material, for pressure water lubrication. Bearing housing shall be provided with a pressure water connection for lubrication, and with slotted holes in base to permit shaft alignment.

(1) Pressure Water Supply: Pressure water supply lines shall be of Type K, hard drawn copper, with streamline fittings, and shall be connected to each bearing to provide adequate lubrication. Headers shall be run from dry well along concrete baffles, with laterals connecting to bearings, each lateral shall be equipped with a needle valve to regulate flow, and with union to permit disassembly. The header in the dry well shall be equipped with a 4" backflow preventer with pressure vacuum breaker, and a solid wedge bronze shut-off valve.

(d) Dry Well Bearings: A self aligning ball bearing type pillow block in cast iron housing, with felt ring seals and pressure grease connections, shall be provided for each shaft, and shall be located in the dry well.

(e) Drive: The drive mechanism shall be of the chain and sprocket type, with gear reducer assembly, for each shaft located above the dry well as indicated on the drawings. The drive shall be for outdoor all-weather operation, with a totally enclosed fan cooled 440 volt, 3 phase electric motor of ample power to provide the maximum torque requirements for continuous operation, and furnished with starters.

(f) Starters: Starters furnished for flocculator drives shall be 208 volts, 3 phase combination air circuit breaker type, full voltage starters in NEMA 4SS, stainless steel enclosure, with inter-connected oil-tight push-button station and red pilot light located at drive unit. A clutch arrangement shall be furnished and installed to enable either flocculation basin to be taken out of service. Chain guards shall be furnished and installed for all drive chains.

(g) Materials: Size and thickness of shaft and thickness of paddle blades are minimum and shall be increased if required by the manufacturer for proper operation of equipment.

(h) Painting: All steel work shall be thoroughly cleaned and scaled in the shop and shall be given one shop coat of Inertol 621. Field painting shall consist of one (1) field prime coat of Inertol 621, and three (3) finish coats of Inertol No. 49 Thick.

(i) Manufacture: The flocculator mechanisms, complete with motor and starter shall be furnished as manufactured by Dorr Co., Walker Process Co., Link Belt Company, Rex Chainbelt, or approved equal.

(j) Drawings: The Contractor shall submit five (5) copies of Drawings and specifications covering the equipment to be furnished, in detail for checking and approval by the Engineer. No fabrication or manufacture shall commence until such drawings and specifications have been approved.

(k) Service: The Contractor shall furnish the services of a representative of the manufacturer of flocculation equipment whose duty it shall be to check installation, initial operation and testing of equipment.

9.13 General Description of Sludge Collector Equipment:

(a) Manufacture: The collector equipment shall be as manufactured by Dorr Company, Eimco or Walker Process, Rex Chainbelt or approved equal.

(b) Size: The collector shall be designed to effectively clean basins of the widths and depths as follows:

No. Collectors	Width	Depth
2	40'-0"	12'-6"
4	45'-0"	14'-0"
2	48'-0"	11'-3"

The collector shall be of the flow through type with a central driving mechanism and center cage with two rake arms. Scraping blades that can be adjusted 1-1/2" vertically shall be arranged to move sludge to a pocket located at the center of the tank. Corner raking bars shall be provided as specified herein. Collecting speed shall be 2 revolutions per hour.

9.14 Center Drive Mechanism: The center drive mechanism shall consist of a turntable base, an internal gear and pinion and shall be so designed that the balls and strip levers can be removed without removing the walkway.

The turntable base shall be bolted to the concrete center column, shall be a high-test 40,000 psi Mechanite metal casting and shall be designed to support the internal gear with the rotating mechanism and the walkway. The top of the turntable base shall be designed to form a platform to provide convenient access to the drive mechanism. The turntable base shall have an annular raceway for a ball race upon which the internal gear rotates. The ball race shall have diameter of at least 42 inches to assure stability without the necessity of guide shoes and shall use large diameter alloy steel balls, which shall bear vertically and horizontally on four renewable special hardened steel liner strips inserted in the turntable base and internal gear. The balls shall run in an oil bath which shall be protected by a felt seal and a steel dust shield.

The internal gear shall be a high-test 40,000 psi Mechanite metal casting and shall be designed to support the center cage and rake arms. The internal gear shall be driven by a heat treated Mechanite metal pinion and shaft keyed to the drive unit worm gear. The center drive mechanism shall develop a minimum torque of 33,000 foot-pounds and the clarifier shall be designed for this torque.

9.15 Drive Unit: The drive unit shall consist of a gear reduction unit driven by a 1,800 rpm TEFC, 55° C, 3/4 H.P. motor, driving the collector by chain and sprocket drive with guard through a worm gear unit. The worm gear shall be keyed to the drive pinion shaft. Thrust of the worm shaft shall be taken by a ball thrust bearing retained by a compression spring and set for operating an overload device. The gear reduction unit shall be of the helical gear type of Falk or equal quality and efficiency, with roller or ball bearings, and shall conform to standards of the American Gear Manufacturers Association for Class II rating and carry a AGA nameplate. It shall be rated for a service factor of 1.25 for 24 hours uniform loading or 10 hour moderate shock loading.

9.16 Electrical Controls: Starters furnished for center drive mechanism shall be 208 volts, 3 phase combination air circuit breaker type, full voltage starters in NEMA 4SS, stainless steel enclosure, with inter-connected oil-tight push-button station and red pilot light located at drive unit. An overload device actuated by thrust from the worm gear shaft shall actuate an alarm located in the control console in the main building.

The overload device shall have a pointer to indicate the load on the mechanism at all times. The overload device shall have two MICRO switches so adjusted that an alarm signal sounds when the load on the mechanism approaches an overload, and to open the motor circuit when an excessive overload occurs. The overload device shall be enclosed in a separate weatherproof NEMA IV stainless housing suitably mounted on the collector.

9.17 Walkway and Center Cage: The walkway shall extend from the tank side to the center of the collector and shall be fabricated of steel as shown on the drawings. The walk shall be of 1-1/2" solid plank Borden banded aluminum grating supported by angles welded to the channel supports with suitable clips. The walkway shall be braced with angle bracing to provide an l/r ratio of 120 or

less. Bracing shall have a maximum l/r ratio of 200. The walkway shall be 3'-0" wide and shall have hand rails secured to posts mounted on the main beams. Handrail shall be as shown on the plans. Similar handrail shall also be provided around the center platform. The steel center cage shall be hung from the internal gear and shall be sufficiently strong and stiff to support and rotate the rake arms.

9.18 Rotating Arms: Two structural steel arms of box truss construction conforming to the tank bottom slope shall be provided. The arms shall be rigidly connected to the center cage and shall be provided with steel adjustable blades for moving the settled sludge along the tank bottom to the sludge pocket. Tie rods shall not be used for the trussed rake arms. The blade setting shall be identical for each arm with the blades so spaced that the entire circular portion of the tank can be raked twice for each revolution of the mechanism. The rake blades shall have a minimum length of 10'. Furnish and install necessary adjustable spring brass squeegees for all blades. The squeegees shall be mounted on the steel blades by bolts and be adjustable a maximum height of 1-1/2". The lowest position of the squeegees shall come within 1/2" of the finished floor at its highest point.

9.19 Corner Blade Mechanism: There shall be furnished and installed in the settling basin a 1/4" guide plate not less than 6" high and anchored to the settling basin wall fillet corners and concrete floor in such a manner to form a square with radical corners.

To the extremity of the rotating rake arms previously called for, there shall be attached a corner blade mechanism arranged to effectively remove the settled sludge in the corners of the tank. Each corner blade mechanism shall consist of two parallel linkage frames of welded steel pipe construction, with the outer ends supporting a pivoted corner blade and the inner ends pivoted to the support frames on the end of the rake arm. The pivots shall be steel rotating in Bronze bushings that can be renewed readily. The outer end of the corner blade shall be provided with a Polyuranthane roller. Each mechanism shall be actuated by stainless steel cable guided over a pocket sheave and provided with suitable weights to keep the guide block on the end of the corner blade in contact with guide plate at all times. The construction of the corner blade mechanism shall be pipe construction in order to add buoyancy. The corner blades and minimum setting shall be of same type as called for the arm blades. Use only one corner blade per arm. The mechanism shall be designed to operate without water in the tank.

(a) Erection: The Contractor shall erect the clarifier mechanism in accordance with the recommendations of the manufacturer. The Contractor shall furnish the necessary oil and grease for the initial 30-day operation, using oil and grease as recommended by the manufacturer.

(b) Painting: All shop and field painting shall be done in accordance with Section No. 13, "PAINTING AND WATERPROOFING".

(c) Telescoping Valves: Furnish and install, as indicated on the Drawings, telescoping valves, or slip pipes of the telescoping type, which shall consist of valve stand, "non-rising" stem, 6-inch slip tube and a riser pipe section with seal for slip pipe. Valve stand shall be equipped with 18-inch handwheel with crank grip and an accurate indicating device calibrated to at least halves of an inch for 36-inches travel. Stems and nuts shall be brass; slip tubes shall be seamless, drawn brass tubing with cast or fabricated bronze bail.

Riser pipe section for telescoping valves shall be furnished by pipe supplier and shall be unlined. Sludge wells seals and necessary flanges or couplings shall be furnished by telescoping valve manufacturer.

9.20 Rapid Sand Filters: The Contractor shall furnish all materials, equipment and perform all labor necessary to construct four (4) dual wash rapid sand filters. Filter shall include the following:

(a) Alternate A shall include dual media, interface filter sweeps, concrete wash water troughs, and Wheeler bottoms.

(b) Alternate B shall include dual media, interface filter sweeps, fiberglass wash water troughs, Leopold bottom with a modified effluent channel, and increased filter wash water influent pipe diameter as shown on the drawings.

9.21 Precast Wheeler Bottom: The precast Wheeler Bottom shall consist of the standard precast false type filter bottoms indicated on the drawings, and shall be furnished and installed in accordance with the following:

(a) Construction: Wheeler bottoms shall consist of 4" thick precast reinforced concrete sections of suitable dimensions to fit the filters, supported on piers above the bottom slab of the filter. Inverted pyramidial depressions shall be on 8-inch centers and shall connect with the chamber beneath the filter bottom through a porcelain thimble with 5/8-inch diameter clear opening. Thimbles shall be molded of porcelain with an integral water-stop collar at the center. The pyramidial depression shall be symetrical and accurate in dimensions, uniformly spaced and parallel to the axis of the filter. The surfaces of the depressions and the top of the Wheeler bottoms shall have a smooth hard finish. The Wheeler bottoms and supporting piers shall be constructed in accordance with an approved detailed layout furnished by the manufacturer. Concrete for construction of the Wheeler bottoms shall be mixed in the preparation, one part Portland cement, one and one-half parts of sand and three parts of screened gravel of 3/4" normal maximum size. All reinforcing for the false bottom, piers, and necessary for anchorage, shall be in accordance with details shown on the plans for the manufacturer furnishing the forms and shall be subject to checking by the Engineer. The Contractor shall be responsible for any misalignment resulting from the setting of the false bottom sections and shall replace any section not meeting the requirements. In checking the finished bottoms for accuracy a 1/16" gauge or feeler shall be used, and if said gauge can be entered between any two of the exposed spheres, the Contractor shall replace such sections with new sections.

(b) Spheres: In each pyramidal depression, there shall be furnished and placed with accurate fit one 3" sphere and four 1-1/2" spheres constructed of porcelain, and truly spherical.

(c) Manufacture: Wheeler bottom forms, thimbles and spheres shall be furnished and manufactured by Builders-Providence or approved equal. The manufacturer shall furnish all necessary anchors for the locking down of the false Wheeler bottom sections.

(d) Drawings: The Contractor shall furnish six (6) sets of drawings covering the Wheeler bottom to be furnished in detail, for checking and approval by the Engineer. The drawings shall detail the necessary anchors and false bottoms, including wall dowels, and detailed layout of the pyramidial depression.

(e) Supervision: The Contractor shall furnish the services of an experienced manufacturer's supervisor, under whose direction filter bottoms are to be installed. Filter bottoms shall be installed in strict accordance with the manufacturer's directions.

9.22 Leopold Bottom Underdrains: In the event the Owner elects Leopold bottoms, the Contractor shall construct filter structural work for the installation of such bottoms in accordance with the alternate details indicated on the drawings. Leopold bottoms shall be of the compound duplex filter bottom type indicated on the drawings, and shall be furnished and installed in accordance with the following:

(a) Material: Leopold filter bottoms of the compound duplex type shall be constructed of salt glazed, vitrified de-aired fire clay tile blocks manufactured for the purpose, and furnished with appurtenances necessary to provide a complete underdrain system.

(b) Setting: Steel anchor rods, furnished by the manufacturer shall be installed in the structural concrete filter bottoms for anchoring tile units. Tile units shall be set level over the entire filter area in setting bed consisting of sand-cement grout. Setting shall include dowels, gaskets and joint plates, as necessary, to insure proper alignment and tight jointing. Upon completion of setting tile units, all space between the rows, and the ends of blocks at walls shall be filled with cement grout composed of one part cement to two parts sand. No water shall be turned into the underdrain system until at least seven days have been allowed for proper curing of grout. The Contractor shall furnish and spread ahead of the tile blocks a 1/2" grout mixed as recommended by the manufacturer.

(c) Supervision: The Contractor shall furnish the services of an experienced manufacturer's supervisor, under whose direction filter bottoms shall be installed. Filter bottoms shall be installed in strict accordance with the manufacturer's directions.

(d) Manufacture: All salt glazed fire clay compound duplex blocks and appurtenances necessary for the installation thereof shall be furnished as manufactured by the F. B. Leopold Company, Inc., Pittsburgh, Pennsylvania.

(e) Drawings: The Contractor shall furnish six (6) copies of layout and working drawings for checking and approval by the Engineer, prior to the furnishing of any of the required materials and appurtenances.

9.23 Filter Media: Filter Media consisting of gravel, sand and anthracite shall be furnished and placed for Wheeler bottom underdrains, or Leopold bottom underdrains, in accordance with the following:

(a) Gravel: Gravel shall be rounded pebbles, screened from deposits of sandy nature, free from splinters and flat pieces. The gravel shall be

of such hard material as will not disintegrate and shall be at least ninety-five per cent (95%) silica. No material obtained from hardpan or clay will be accepted. Likewise schist, shale or limestone will not be accepted. Gravel shall not contain any dirt, dust, clay or sand. When shaken in water, it must leave the water clean and clear. Material shall be subject to test prescribed under A.S.T.M. Designation C131-69 (1975).

Abrasion under said test shall be not more than nine per cent (9%) at 100 revolutions nor forty per cent (40%) at 500 revolutions for test of the largest size layer of stone. Samples of material shall be submitted to the Engineer for approval.

(1) Wheeler Bottoms: Depth of filter gravel shall be to a level 12 inches above Wheeler bottoms, with layers of depth and size as follows:

Depth in Inches	Size in Inches
3"	5/8" - 1"
3"	3/8" - 5/8"
2"	1/8" - 3/8"
4"	1/8" - 16 mesh

(2) Leopold Bottoms: Depth of filter gravel shall be to a level of 12-inches above Leopold bottoms with layers of depth and sizes as follows:

Depth in Inches	Size in Inches
2"	1/2" - 3/4"
2"	1/2" - 1/4"
2"	1/4" - 1/8"
6"	1/8" - 16 mesh

(b) Sand: Sand filter media shall be placed on top of the gravel to a depth of 14-inches. The filter sand shall be clean river, lake or bank sand, with either sharp or rounded grains, and shall not contain more than one per cent (1%) by weight of flat or laminated particles. The sand grains shall be of hard material which will not disintegrate, and shall contain at least ninety-five per cent (95%) of silica computed as SiO_2. The sand shall contain not more than five-tenths (0.5%) per cent of lime computed as calcium oxide and which is finer than thirty-six hundredths (0.36) of a millimeter, nor more than one and five-tenths (1.5%) per cent of iron, nor more than five-tenths per cent (0.5%) of loam, clay and dust, and shall be entirely free from perishable matter, cinders and other trash. If necessary, the sand shall be washed and screened to produce filter sand of the proper quality and size. Applicable to either type of bottom. All sand shall be completely free of silt, clay and mica.

All filter media shall be free from organic matter. Media shall be tested for solubility in dilute acid and shall be 97% insoluable in cold dilute sulfuric acid.

The sand shall have an average specific gravity of 2.63. After the sand is placed, the filter shall be backwashed thoroughly, then the sand shall be skimmed to remove fines and debris. After washing and skimming the sand shall have an effective size of 0.42 to 0.46 mm and a uniformity coefficient of 1.35.

(c) Anthracite Media: The top layer of the filter media shall consist of specifically selected and graded anthracite media of 12 inches final depth, after backwashing and skimming. The media shall be confined to particles sizes ranging from 1.0 mm to 1.4 mm. with not more than 10% by weight being larger than 1.4 mm nor more than 15% by weight being smaller than 1.0 mm. It is intended that after hydraulic classification in place by backwashing and removal of the filter material by skimming, essentially all of the particles smaller than 1.0 mm be removed. Sufficient excess material shall be furnished to anticipate this requirement. Anthracite media shall have a specific gravity of approximately 1.57, hardness (Moh scale) of 3.0, and shall be essentially free of iron, sulphides, clay, shale, extraneous dirt, and excessive dust.

(d) Transporting: Especial care shall be taken in transporting gravel and sand to prevent contamination by foreign matter than will be difficult to remove, such as paper, sticks, cinders, etc.

(e) Testing Filters: Before any filtering media is placed in the filter beds the Contractor shall thoroughly test and make sure each filter is free from leaks. The underdrain systems shall be thoroughly flushed out. Applicable to either type of bottom.

(f) Placing Media: In placing the gravel the Contractor shall mark off on one of the four walls of each filter the levels of each grade of gravel called for; then by means of controlled water levels at these marks place each class of gravel separately and in the order specified. As the placing of gravel progresses the water level in the filter box must be kept to the proper marking for the grade of gravel being placed. Chutes for placing the gravel are permitted provided a landing board 4' x 4' is placed under the end of the chutes and a means of preventing scattering of the gravel is provided for the chutes. After each filter has had all gravel placed, the Contractor shall give the bed a thorough washing. In placing the sand and anthracite media the same specifications apply as for the gravel except that the Contractor may chute the media onto the landing boards in larger piles than for the gravel. The finished filter shall then be given at least three washes and the surface level checked for proper depth below the filter trough. Adjustments shall be made by the Contractor to each filter bed at the end of thirty-day operating or maintenance period.

9.24 Filter Surface Wash: Surface wash assemblies for each filter shall be furnished and installed. Each filter will require two surface wash assemblies 14'-6" overall diameter.

(a) Filter Sweeps: The filter sweeps shall be standard Type QJ straight-line surface agitators as manufactured by F. B. Leopold Company, Inc.

All piping for the arms and nozzles shall be constructed of bronze. The main supply pipe to each filter sweep shall be 2" brass pipe of suitable length to place the filter sweep at the sand-anthracite interface, and shall connect to the filter sweep headers. Solid wedge gate valves on filter sweeps shall have adjustable valve stops.

(b) Filter Sweep Headers: The Contractor shall furnish and install all necessary headers for the four filter sweeps in each cell consisting of Leopold Model No. MRP pipe, fittings, and victaulic couplings.

(c) Agitator Supply Header Supports: Header supports shall be stainless steel .188 inch minimum thickness with stainless steel .375 inch minimum "U" bolts, Model No. (HS-SS), as manufactured by Leopold or approved equal.

(d) Agitator Supply Downpipe Stabilizers: Stainless steel downpipe stabilizers of equal thickness to supply header supports Model No. (DS-SS), as manufactured by Leopold or approved equal shall be furnished and installed.

(e) Water Supply: Each agitator shall be designed to deliver 290 gpm @ 85 psi.

9.25 Chemical Feed Equipment: Chemical feed, feed control, chlorinator and monitoring equipment shall be furnished by one manufacturer except as specified below and shall be completely compatible with the existing Wallace and Tiernan, Penwalt, equipment. Other manufacturers equipment may be bid in the spaces provided in the Proposal but the manufacturer shall submit a complete list and catalog information of proposed equipment together with any variations from the Specifications two weeks prior to the bid date.

9.26 Carbon Feed Equipment: The existing carbon feeder, solution tank, make-up tank, solution pump, and spray nozzles shall be replaced as early as possible in the project, as follows:

1 - Volumetric screw type feeder, 28 pounds per hour capacity with adapter plate and flexible connector to existing converging hopper; Dual flushing cones; SCR variable speed drive with speed readout; 1/4 HP, 115 volt d.c. explosion proof motor and tachometer; remote speed control station with speed read out. Wetted parts shall be bitumastic coated.

1 - 200 gallon capacity 316 stainless steel carbon slurry tank with two mixers.

1 - Stainless steel slurry pump 80 gpm @ 70 feet TDH with 5 HP, 200/230 volt, 3 phase explosion proof motor.

28 - Spray nozzles for carbon shall be of the flat, 90°, high impact, sharply defined spray pattern without heavy edges and of one piece design. Nozzles shall be for 3/8" pipe size with a capacity of 3.0 GPM at 40 psi. Material of nozzles shall be 303 stainless steel and shall be Fan-Jet Type V as manufactured by Industrial Nozzle Division of Wm. Steinen Manufacturing Company of Parsippany, New Jersey, or approved equal.

9.27 Lime Slaking Equipment: Furnish and install two (2) paste type lime

slakers, each with a capacity range of 50#/hour to 1,000#/hour. Slaking system shall be equal to Wallace and Tiernan Series A-758 or BIF Model with similar functions. The system shall have fully automatic control of slaking water.

Feeder motors shall be controlled on a start-stop basis by a pulse duration signal proportional to total filter flow. Feeder motor speed shall be controlled by a manual set or a pH controller signal.

Provide a pneumatic pH indicating controller equipped with reset and proportional band functions.

The slaker shall consist of slaking compartment of heavy gage steel; two (2) sets of counter-rotating, intermeshing mixing paddles, a dilution chamber equipped with slurry mixing rakes, a classifier for grit separation and washing, and a motorized continuous grit removal system. The slaker is equipped with a torque-operated water valve which maintains the desired water-lime ratio over a 20 to 1 range. No auxiliary hot water or heat exchange equipment is required. A switch is provided to stop the quick lime feeder and actuate an alarm if either the mixing shaft or grit conveyor drive shaft stops turning. The slaker mounted control panel includes magnetic starter and selector switch for feeder with hand, off and automatic positions with running light, or start-stop switch with signal light, magnetic starter and start-stop button with running light for slaker motor; magnetic starter and start-stop button with running light for grit-remover motor; alarm lights for feeder and slaker drives; and alarm actuator for remote alarm.

Each slaker shall include the following:

W&T Series 320210 belt type volumetric feeder equipment with 1/4 horsepower, SCR variable speed drive for flow proportional control from a pulse duration flow signal

Remote speed control station

Motorized grit remover

Prewired control panel with manual disconnect switch

Manual rotary valve and adapter

Inlet and discharge flexible connections for feeder

Sample tray

Set of spare parts to include 6 shear pins for grit remover, 2 paddles, control valve diaphragm, rubber boot, water valve disc, 4 pintle chain links, 2 flight scrapers and spare gaskets

9.28 Bulk Lime Storage Hopper:

(a) General: The bulk lime storage hoppers shall be 13'-0" in diameter, with a side wall height of 13'-8½", cone section with a height of 10' -8" and 8" connector section to feeder. The hoppers shall be designed on the basis of a maximum lime weight of 45 lbs. per cu. ft. and a storage level of 6" from the top of the hopper.

(b) Shop and Erection Drawings: Shop and erection drawings shall be submitted in five (5) copies with complete details of all steel, steel piping connections, access hatch, ladder, and all other appurtenances shown on the Drawings and with details of the assembling of all items

required for the complete installation.

(c) Material: The hoppers shall be fabricated from high-quality steel plate and structural shapes conforming to ASTM Specifications A-36-75 - Structural Steel. Minimum plate thickness shall be not less than 1/4". Pipe flanges shall be ASNI standard 150 lb. flanges.

(d) Equipment: Furnish and install in each hopper the following equipment:

One - Syntron Model V-51 vibrator with timer for hopper converging section.

Two - Bindicator Model A switches for high and low level indicator.

One - Torit Model TD 468 hopper vent, equipped with 3 HP, 200/230 volt, 3 phase, TEFC motor.

One - Access manhole 4'-0" diameter, gasketed and bolted.

One - 4-inch flanged fill pipe connection.

One - Inside steel ladder.

(e) Painting: After erection, all damaged and abraded areas of interior and exterior surfaces of the hoppers and appurtenances shall be spot cleaned. Shop priming, field priming and finish coats shall be in accordance with the Painting Schedule, Section 13 of these Specifications.

(f) Lime Hoppers Filler Piping: Furnish and install steel pneumatic feed piping from the loading area to hoppers as shown on the Drawings. The pipe shall be Schedule 40 steel pipe galvanized inside and outside with standard ring flanges Class B strength and seal welded. The outside surfaces and supports shall be painted in accordance with Section 13 of these Specifications.

9.29 Existing Post-Lime Feeder: The two existing post lime feeders and the bucket elevator shall be relocated in the existing chemical feed building. The feeders shall be connected for proportional control by the raw water meter.

9.30 Fluoride Feed Equipment: Two diaphragm type metering pumps for fluosilicic acid shall be furnished and installed. Each pump shall have a capacity of 500 gpd, and shall be furnished with SCR variable speed drive with speed readout, 1/4 HP, 115 volt d.c. TEFC motor; Electric stroke positioner for flow proportional control; and pump mounting table. A back pressure valve shall be installed in the pump discharge. The stroke position shall be controlled by a pulse duration signal from the main control panel. A signal converter shall be furnished if required.

9.31 Fluoride Storage Tank: Furnish and install one 6,000 gallon rubber lined, horizontal steel tank as shown on the Drawings with flanged connections as follows:

One - 20" Access Manhole
One - 2-1/2" Fill
One - 2" Vent
One - 6" Level Gauge
One - 1-1/2" Discharge

9.32 Storage Tank Level Monitor: The liquid level shall be monitored a non-contact type ultrasonic system. The sensor shall be Kynor encapsulated, temperature conpensating, mounted 16-inches above the crown of the tank. The receiver and transmitter shall be of solid state construction mounted in a NEMA 1A enclosure and shall contain a 4-1/2-inch indicator graduated 0-6000 gallons with high and low level alarm contacts. The transmitter shall produce a linear 4-20 m.a. signal to a recorder in the main metering panel. The system shall be Type FM9 as manufactured by Western Marine Electronics or equal.

9.33 Fluoride Day Tank and Scale: Furnish and install on scale one (1) 100 gallon rubber lined steel tank. All connections shall be flanged at top of tank as shown on the drawings. Scale shall be a 1700 lbs. capacity portable dial scale with 24 x 30 inch platform and loss of weight recorder, Wallace and Tiernan No. 130.160, or approved equal.

9.34 Chlorination Equipment: Furnish and install new equipment and modify existing equipment to make a complete chlorination system as shown on the Drawings and/or specified. The work shall include the following:

(a) Replace one existing 400#/day chlorinator with one - Wallace and Tiernan Series V-800 modular 2,000#/day chlorinator equipped for 1,500#/day capacity. The chlorinator shall be furnished as follows:

(1) Pneumatic plug positioner for flow proportional control with air pressure regulator, filter and gauge.

(2) Pneumatic computer with 0.1 to 1.0 ratio for remote dosage set.

(3) Local pneumatic set control station including air pressure regulation, filter, gauge, and a 3-way hand-automatic selector valve.

(4) Solenoid valve for remote chlorine flow recording.

(5) Injector stop-start switch.

(6) Header valve and double union to connect to 3/4" seamless steel gas header.

(7) 2-inch Bellofram type injector.

(8) Water pressure gauge.

(9) Set of minor accessories to include wrenches, gaskets, ammonia and lubricant.

(10) One each extra rotameter, V-notch plug, chlorine pressure reducing valve cartridge, and diaphragm regulating valve.

(b) Modifying existing Wallace and Tiernan Series V-800 400#/day capacity chlorinator presently feeding chlorine gas to the silactor. Provide injector to feed chlorine solution to distributor panel.

(c) Chlorine storage, supply, and distribution equipment shall be furnished and installed including.

(1) One - pipe lever scale for five - one ton chlorine cylinders with dial and loss of weight recorder.

(2) Five sets - ton container valves and fittings to include union type auxiliary ton container valves, header valves, and flexible connections.

(3) Two - chlorine gas pressure regulators and filters with four extra filter pads, four isolation valves and unions.

(4) Eleven - 2-inch corporation stops and plastic tube main connections, six for raw water main, five for finished water main, including flexible hose connections, pipe to hose adapters and clamps.

(5) Twelve sets - wood block cradles for ton containers.

(6) Three - chlorine injectors.

(7) One - Chlorine pressure switch alarm accuator U20813.

9.35 Post Flash Mixer: Furnish and install one (1) flash mixer mechanism, complete with supports and motor drive, at the location shown on the drawings. The mechanism shall be equipped with vertical electric motor drive, mounted on steel beam supports on top of the flash mixer, with vertical shafting for the rotating element within the chamber below, and shall be hydraulically balanced and free from vibration.

(a) Capacity: The mechanism shall be capable of continuously blending 21,000 GPM of chemically treated water, so that at points of discharge the concentration of coagulants shall be uniform.

(b) Vertical Shaft and Bearings: The vertical shaft shall be of steel, mounted in suitable anti-friction bearings, and supported in a suitable housing. Bearings shall be of ample capacity for all thrust loads.

(c) Rotating Element: The rotating element shall be designed and sized so as to transfer the energy of the motor at full rated load, to the water passing through the flash mixer, and shall rotate at approximately 56 RPM.

(d) Motor: The electrical motor for operation of the flash mixer shall be 480 volt, 3 phase, 60 cycle, 870 RPM with weatherproof enclosure, of ample size to operate the flash mixer without overload, and with a minimum full load rating of 10 HP, furnished with starter.

(e) Manufacture: The flash mixer mechanism complete with motor shall be furnished as manufactured by Dorr Co., Walker Process Co., Rex Chainbelt or approved equal.

9.36 Air Supply System shall be furnished and installed to supply all pneumatic instrumentation and for the dust collectors on lime storage hoppers.

(1) Compressor-Storage Units shall consist of two (2) 1.0 HP, 200 volt, 3 phase, 60 Hertz, oil-less air compressors, each with a capacity of 8.2 SCFM at 100 PSIG, each unit mounted on a 30 gallon Receiver, factory assembled.

Pressure switches shall be set at 50 psi and 60 psi start, 70 psi and 75 psi stop. An automatic alternator shall be installed to alternate the lead and lag compressor sequence. The starters and the alternator shall be furnished in NEMA-1 enclosure.

(2) Refrigerated Air Dryer shall be furnished and installed in the instrument supply header. The dryer shall deliver 5.7 CFM of 35° F. dew point air with an inlet of 100° F. saturated air inlet. The dryer shall be for 115 volt, 60 Hertz, single phase operation.

(3) Accessories. The system shall include all strainers, valves, unions, and all other items required for the satisfactory operation and maintenance of the system.

9.37 Payment: No separate payment will be made for work under this Section of the Specifications. The cost of such work and all cost incidental thereto shall be included in the prices bid for the item to which the work pertains.

SECTION NO. 10

METERING AND CONTROL

10.01 Scope: The work covered under this Section of Specifications consists of furnishing and installing metering equipment, control consoles, and monitoring panels.

10.02 General Description: The following metering, instrumentation and control functions shall be furnished or reconditioned and installed under this Section of Specifications:

(a) Metering Equipment:

(1) Existing River Water Meter

(2) Filtered Water Rate Controllers

(3) Raw Water Rate of Flow Controllers

(b) Instrumentation Equipment:

(1) Filter Console

(2) Turbidity Monitors and Recorders

(3) Existing pH Monitors and Recorders

(4) Existing Chlorine Residue Monitors and Recorders

(5) Chemical Feed Controls

(6) Basin Level Transmitter

10.03 Manufacturer: All equipment under this Section of Specifications shall be compatible with the existing metering and instrumentation equipment. The equipment manufacturer shall furnish all wiring and control schematic diagrams.

10.04 Control Consoles and Filter Operating Tables: Control consoles shall be of highest quality construction. Dimensions shall be as shown on the plans. The panels shall be stiffened in a manner acceptable to the Engineers in order to provide a rigid panel without deflection in normal handling. Detail drawings of panel construction shall be submitted for approval. Details of panel construction and installation shall be as follows:

(a) Assembly, Piping and Wiring: Panels and consoles shall be factory assembled and tested. All electrical and pneumatic connections shall be made to terminal blocks. Terminal blocks shall be numbered and lamacoid function schedule and piping diagram attached to the rear of the panel indicating the function of each terminal strip. Terminal strips shall be located in the bottom of the panel. All units shall be completely accessible from the rear. Piping and wiring shall be shop tested before shipment. A certification of shop test will be required prior to shipment. No air leaks shall be acceptable. Chemical feed control equipment will

be installed by the feed equipment manufacturer in the field. Terminals for electrical and pneumatic connections shall be furnished and factory installed under this Section. All terminal blocks for the metering and instrumentation console shall be as specified on the Drawings for each lead entering the panels.

(b) Central Monitoring and Control Panel: The panel shall match the existing panel and shall be of formica and aluminum composite construction. Welded aluminum extruded sections shall fit with the formica panels and backing to provide a rigid panel.

(c) Filter Consoles: Filter consoles shall be free standing, constructed of molded fiberglass reinforced polyester liminate having a minimum wall thickness of 1/8". The ends and center section shall be chemically bonded and mechanically fastened to provide a unit structure. All joints shall be provided with a removable molded vinyl trim strip to provide a modern appearance.

The console laminate exterior shall be covered with an integrally molded gel coat 15 mils. in thickness to provide a smooth surface. The cabinet liminate shall be constructed by the use of 10 oz. fiberglass cloth, fiberglass mat, and 24 oz. woven roving and shall contain minimum of 35% by weight of fiberglass reinforcement. The color of the consoles shall be selected by the Engineer from samples submitted by the manufacturer.

All corners, except for the base shall be rounded and the cabinet provided with a flanged base for direct bolting to the operating floor as shown on the Drawings. The front of the cabinet shall be solid and the rear shall be fitted with a latched removable panel of material identical to the console cabinet.

(d) Finish: Consoles and panels shall match existing panels in color and finish.

(e) Nameplates: Each instrument or control device shall have engraved formica nameplates matching existing nameplates. Nameplate titles shall be as shown on the Drawings.

10.05 Filter Receiver: Filter gauges shall be furnished and installed on the central monitoring and control panel as indicated on the schematic and other drawings and specified herein. Gauges shall consist of three units for each filter and shall be operated pneumatically from the rate of flow transmitters and loss of head transmitters to be installed as specified under the paragraph "Transmitters" of this Section of Specifications. The three units to be provided for each filter shall consist of rate of flow, and loss of head and turbidity receivers.

(a) Pneumatic Operated Mechanisms: The operating mechanisms for filter gauges shall be of the flexible metallic bellows type constructed of corrosion resistant material throughout and actuated by the output of the pneumatic transmitters.

(b) Electric Operated Mechanism: Turbidity recording equipment shall transmit two signals from each filter, one for finished water turbidity and the other for turbidity at the interface between sand and anthracite.

(c) Recorders: Furnish and install recorders for each system consisting of a one unit strip recorder for flow. A two unit strip recorder for head loss (total and interface) and a two unit strip recorder for turbidity. Recorders shall be similar to Taylor Model 90JF217.

10.06 Transmitters: Transmitters of the pneumatically operated type as indicated on the schematic drawings shall be furnished for operation of filter receivers specified above and shall be as follows:

(a) Filtered Water Rate of Flow Transmitter: The pneumatic rate of flow transmitter shall be of the mercury well type, shall deliver a signal ranging from 3 to 15 psi directly proportional to flow for operation of the filter gauges and for operation of the summator specified elsewhere in these Specifications. The pneumatic flow transmitter shall be similar to Model ATUAX as manufactured by Builders-Providence, Inc., or Model PN as manufactured by Simplex Valve and Meter Company. All transmitters shall be floorstand or bracket mounted.

(b) Loss of Head Transmitter: Loss of head transmitter shall be of force-balance type constructed of a series of non-metallic diaphragm assembly, and shall provide an output pressure ranging from 3 to 15 psi proportional to the difference in loading pressures and filter loss of head. Loss of head transmitters shall be mounted on the exterior of the respective filter flow transmitter housing. Sediment traps shall be installed for each loss of head transmitter. Transmitters shall be similar to Model AT-SD as manufactured by Builders-Providence, Inc., or Model TD as manufactured by Simplex Valve and Meter Company, and shall be mounted on the rate of flow transmitter floorstand.

(c) Turbidimeter: Furnish and install a system for each of the four (4) proposed filters to measure the turbidity at the dual media interface and the effluent. The system shall consist of a reflected light 0.1 to 1.0 parts per million range primary instrument with standardization rod, local indicators and remote dual pen strip recorders. Equipment shall be of Hach, Minneapolis-Honeywell or equal manufacture. Electrical wiring between primary units and recorders shall be in accordance with equipment manufacturer's published instructions.

10.07 Existing pH Cell, Indicator and Transmitter: Relocate the pH cell and transmitter from the existing filter gallery to the post chemical building. The signal from the transmitter shall control the post lime feed rate in proportion to the square of the differential between transmitter signal and the set signal. The pH signal shall also be connected to the existing recorder in the central meter panel.

10.08 Existing Chlorine Residual Analyzer: Relocate the chlorine residual analyzer from the existing filter gallery to the post chemical building. The transmitter shall be reconnected to the recorder in the central meter panel.

10.09 Basin Level Transmitter: Furnish and install a pneumatic basin level transmitter to measure the influent level to the new filters. The level shall be measured in junction box adjacent to the existing settling tank. The transmitter shall produce a linear 3-15 psi signal for a level range of 0-24-inches.

The signal shall be connected to the selector valve in the central meter panel.

10.10 Raw Water Rate of Flow Controller: Furnish and install one 42-inch indirect acting raw water rate-of-flow controller consisting of a Hershel short form venturi with a hydraulically operated butterfly valve in the meter throat. The controller shall have a range of 4.0 to 44 MGD at 80-inches differential, and shall include a mercury well pneumatic transmitter, balanced cell valve controller, local flow rate indicator and rate set station. The flow signal shall control the chlorinators, pre-lime feeders, carbon feeder, and alum feed pumps proportional to the flow. The controller shall also have a remote recorder and rate set station located in the existing monitoring panel.

10.11 Rate of Flow Controllers: Filtered water rate of flow controllers shall be 16" size in direct acting Type BIF Model 603 or approved equal. The controller shall be designed to regulate flow at rates from 1.35 to 5.5 million gallons per day. The controllers shall be accurate to within plus or minus 3% over the 4 to 1 range. Control shall be remote using basin level control or local from the filter operating console.

10.12 Existing 20-Inch Venturi Meter: The existing 20-inch flanged end raw water venturi meter located underground near the chemical building with its transmitter shall be cleaned, reconditioned and relocated in the post chemical feed building as shown on the Drawings.

10.13 Modifications to Existing Monitoring Panel: The following connections and modifications shall be made in the existing monitoring panel:

(a) Connect signal line from existing relocated pH and chlorine residual cells to existing receivers in existing monitoring panel.

(b) Install new indicator for 42-inch raw water rate of flow controller (0-45 MGD) in place of 20" river water flow indicator.

(c) Connect flow signal from 42-inch controller to existing summator in place of signal from existing 20-inch raw water meter. Recalibrate summator (0-45 MGD).

(d) Connect flow signal from each of the four (4) new filter flow controllers to the existing summator. Recalibrate summator 0-45 MGD.

(e) Recalibrate existing total filter flow recorder 0-45 MGD.

(f) Connect existing master filter set rate signal to each new filter console local remote selector valve. Recalibrate master set rate indicator (0-45 MGD).

(g) Install a manually operated 3-way selector valve (matching existing selector valves) adjacent to the master rate set manual/automatic selector valve. Connect the signal piping from the existing and new basin level transmitters so the master rate set can operate on either level signal.

10.14 Central Monitoring and Control Panel Addition: The panel addition shall include the following indicators, recorders and controls:

Four - Filter Rate Recorders

Four - Loss of Head Recorders

Four - Turbidity Recorders

Four - Filter Rate Set and Indicators

Four - Manual/Automatic Selector Valves

One - Indicator for Existing 20-inch River Water Relocated from Existing Panel.

One - Fluoride Level Indicator

One - Annunciator for Alarm Signals, SCAM 5144 or approved equal

Work shall include all wiring and pneumatic piping and all other work required for a complete system.

10.15 Payment: No separate payment will be made for work under this Section of the Specifications. The cost of such work and all cost incidental thereto shall be included in the prices bid for the item to which the work pertains.

SECTION 11

MECHANICAL

11.01 Description: These MECHANICAL GENERAL provisions specified herein apply to all Parts of Section 11.

11.02 Space Conditions: Drawings indicate locations of fixtures, apparatus, ductwork and piping, and while these are to be followed as closely as possible, if it is necessary to change the location of same to accommodate building conditions, make changes without additional cost to the Owner and as approved by the Architect.

Provide access to equipment and apparatus requiring operation, service or maintenance within the life of the system.

Do not run piping or ductwork, or locate equipment, with respect to switchboards, panelboards, power panels, motor control centers or dry type transformers:

Within 42" in front of equipment.

Over equipment, or within 36" horizontally of same space.

11.03 Continuity of Service: Schedule work so existing systems will not be interrupted when they are required for normal usage of the existing building.

Perform work at such time and in such manner as to cause minimum inconvenience to the Owner and as approved by the Architect. No allowance will be made for lack of knowledge of existing conditions.

11.04 Protection of Work During Construction: Provide protective covers, skids, plugs or caps to protect equipment and materials from damage and deterioration during construction.

11.05 Existing Equipment & Systems: The existing installation is to remain as at present except as otherwise indicated or specified. Perform all work necessary to properly tie in the new work with the existing work and to adapt the existing work to the changes in the building and systems.

Remove exposed piping and ductwork rendered useless due to changes. Plug outlets in piping. Blank-off openings in ductwork.

Remove concealed piping which is exposed by the removal of walls, partitions, etc., and reconnect as required.

Sleeves left open by removal of piping shall be cut, flush with the finished slab, filled with cement grout flush with both sides of slab.

Material and equipment which has been removed shall not be used in the new work, except as specified.

Where existing piping and/or equipment is shown on the drawings, its size and location shall be verified.

Rebalance the existing duct systems to produce the air distribution shown.

Reused grilles, registers, multivaned deflectors, louvers, screens and dampers shall be in first class condition or new shall be installed.

11.06 Related Work Described in Other Sections: Installation of access panels in wall and ceiling construction.

Cutting, coring, waterproofing, and patching of walls, floors, ceilings, roofs and structure of existing buildings.

Painting, except as specified herein.

Installation of starters, contactors, thermal overload switches, and remote push buttons, except as specified herein.

Door grilles.

Door undercuts.

Structural platform to support the heat rejection equipment.

Louvers and screens.

11.07 Utility Connections & Service: Natural Gas: Arrange with the Gas Company to make changes in the existing gas meter installation to provide sufficient gas service for a flow as indicated in the drawings and at pressure indicated. Pay all charges in connection with the installation.

Install a gas pressure regulator in the gas line to each building. Each regulator shall be a self-contained, balanced diaphragm gas pressure regulator complete with "O" ring disc, bevel faced seat ring and minimum lock-up with either high or low inlet pressures. Regulators shall be capable of delivering the required capacity for the available inlet pressure with the reduced outlet pressure range required. Regulators shall be Rockwell, Maxitrol or Fisher.

11.08 Substitutions: Substitution submittals shall include complete description of the proposed substitute, the name of the material or equipment for which it is to be substituted, drawings, cuts, performance, test data and evidence that the proposed manufacturer or his established representative maintains a qualified service organization including spare parts and is available for competent service on short notice.

11.09 Shop Drawings: Mark shop drawings indicating the particular make, model number, accessories, options and specification paragraph numbers. Shop drawings for equipment to be mounted on vibration isolators shall include operating weight and load distribution at each mounting point.

Submit shop drawings listed below:

Foundations and housekeeping pads showing contact surfaces and overall outlines of equipment mounted thereon

Insulation

Gauges

Pumps and pump curves

Controls including control diagrams, control panel layouts, descriptions of operation and cuts of instruments

Air compressors

Valves

Unit heaters

Hot water heating specialties

Boiler

Boiler trimmings and controls

Heating and ventilation units

Compression tanks

Electric heating coils

Sheet metal work

Dampers

Louvers and screens

Grilles, registers and diffusers

Air cooled condensing units

Air conditioning units with coil, fan and filter data

Refrigerant piping diagrams and layouts approved by compressor manufacturer

Fan and refrigeration room and suspended air conditioning unit layouts showing all equipment, sheet metal work and piping with thermometers, thermometer wells, gauges and gauge cocks (1/2" = 1'0" min. scale).

11.10 Maintenance Data: Submit three manuals covering details of operation and maintenance for all apparatus requiring service including:

Service telephone number of the installing contractor.

Manufacturer's operating and maintenance manuals, including parts lists, for each piece of equipment and accessory requiring service or maintenance, the guarantee period and the name, address and phone number of the nearest sales and service organization for each item.

Step-by-step procedure for starting and stopping each system including a step-by-step procedure for firing the boiler.

Temperature control diagrams.

Valve lists and diagrams.

As installed boiler piping diagram, gas piping diagram and boiler control wiring diagram.

Copies of inspection certificates provided by the City, County and State.

A copy of the diagrams, start-stop procedure and valve list shall also be framed under glass and mounted in the Boiler Room.

11.11 Cleaning: Flush water piping systems until water runs clean.

Remove all stickers, rust, stains, labels, and temporary covers before final acceptance.

Remove foreign matter from equipment, piping and ductwork systems and appurtenances.

Clean and polish identification plates.

11.12 Guarantee: That each piece of apparatus shall be of the customary standard and quality furnished by the designated manufacturer for that catalogue number.

That the air systems shall operate without aerodynamic noise generated from the faulty installation of ductwork or any component of the air distribution system.

11.13 Instruction of Operating Personnel: Arrange formal instruction sessions for the Owner's operating personnel, covering:

General familiarization and operating procedures for the entire mechanical installation.

Routine maintenance procedures for all mechanical equipment.

Specific operating and maintenance procedures for the boiler.

Specific operating and maintenance procedures for the automatic control systems.

Obtain receipt from the Owner's representative acknowledging completion of each item of instruction.

11.14 Hangers & Supports: Supports for steel pipe and for copper tubing 1-1/4" or larger, shall not be more than 10' apart. Supports for copper tubing 1" and smaller shall be not more than 8' apart. Pipes shall be supported within 1' of each elbow.

Hangers and hanger rods for steel pipe shall be wrought or malleable iron.

Hot water risers shall be anchored and allowance made for expansion.

Pipe hangers for steel pipes 2-1/2" and smaller, shall be split ring type, adjustable swivel ring hangers; Grinnell 104, Fee & Mason 199, or Elcen 92.

Support heating piping 3" and larger on Grinnell 171, Fee & Mason 170 or Elcen 15 pipe roll hangers with Grinnell 160, Fee & Mason 171 or Elcen 221 pipe covering protection saddles.

Hangers for copper and PVC piping shall be PVC coated, Grinnell CT-99C, Fee & Mason 381 or Elcen 389.P.

Hangers shall be complete with rods and supports proportioned to the size of pipe to be supported.

Support piping 2-1/2" and larger in new concrete construction, from adjustable type inserts Grinnell 282, Fee & Mason 2570 or Elcen 65. Where weight to be supported by an insert is 300 lbs. or more, install two #3 reinforcing rods, 3' long thru yoke of insert.

Inserts installed in existing concrete construction and for piping 2-1/2" and smaller shall be Rawl "SABER-TOOTH", or Phillips "RED HEAD", self drilling shells.

Support piping in bar joist construction with Grinnell 67 or 64 or Fee & Mason 260 clamps.

Do not pierce waterproofing with support bolts.

Size hangers for insulated piping to bear on outside of insulation except split ring hangers for heating piping may be installed bearing on the pipe.

Provide Fee & Mason 81, Grinnell 167 or Elcen 219 insulation protectors at hangers bearing on outside of insulation.

Support vertical steel piping for heating to building structure.

11.15 Sleeves: Provide where pipes pass thru walls and floors.

Sleeves shall be standard weight steel pipe.

Floor sleeves for exposed piping shall extend from the bottom of the slab to 4" above the finished floor in equipment and fan rooms, 3/8" above finished floor elsewhere.

Wall sleeves shall be full thickness of walls.

Make sleeves thru outside walls watertight. Caulk between uninsulated pipe and sleeve with oakum and lead. Pack and caulk between insulated pipe and sleeve.

Size sleeves for insulated pipes to allow full thickness insulation.

11.16 Motors & Starters: Provide motors, starters, push buttons, thermal overload switches, and contactors for equipment covered herein unless otherwise specified. Installation of starters, push buttons, and thermal overload switches and contactors, not factory installed, is specified under another Section.

Motors 1/2 HP and larger, shall be wound for 208V., 3-phase, 60 cycle current; motors smaller than 1/2 HP shall be wound for 120V., 1-phase current, unless otherwise specified. Name plates shall show the above voltages. Open frame, splashproof and totally enclosed motors shall be rated on a 40°, 50°, and 55°C. temperature rise basis, respectively.

Select motors for operation within their nameplate amperage.

Motors shall be of the induction type, unless otherwise specified.

Motors not furnished with equipment shall be Allis-Chalmers, Century, Delco, General Electric, Ideal, Louis-Allis, Wagner or Westinghouse.

Starters shall have overload protection for all hot lines. This will require 3 overload relays for 3-phase motors and 1 overload relay for 1-phase line-voltage motors.

Unless otherwise specified, provide each motor 1/2 HP and larger with a magnetic starter, Allen-Bradley 713, combination magnetic starter and circuit breaker, providing overload and low voltage protection.

Equipment furnished with factory installed motor starter units shall also be equipped with individual motor branch circuit protective devices interconnected on their line sides to lugs sized to receive a feeder with minimum ampacity of 125% of total connected load.

A Hand-Off-Auto, switch shall be mounted on the face of each starter.

Provide a 120V control circuit transformer with fused primary circuit in the enclosure of each air conditioning compressor motor starter.

Unless otherwise specified, provide for each motor smaller than 1/2 HP a manual starting switch with thermal overload protection with Hand-Off-Auto selector switch, pilot light, and stainless steel cover plate equal to Allen-Bradley 600. Switches installed on finished walls shall be flush type.

Each starter, contactor, push button station and thermal overload switch, shall be appropriately identified by engraved laminated bakelite nameplates with 1/4" high white cut letters.

11.17 Drive Guards: Provide guards shielding the perimeter and face of all new belt drives, shafts and couplings. Provide openings opposite driver and driven shafts to permit use of revolution counter.

11.18 Foundations: Provide foundations for floor mounted equipment covered herein except where otherwise specified.

Concrete foundations shall conform to the following schedule:

Pumps, Floor Mounted	4" high pad
Boiler	4" high pad
Air Cooled Condensing Units	4" high pad
Floor Mounted Equipment Located in Equipment Rooms, Not Listed Above	4" high pads or curbs as indicated

Concrete shall be 1:2:4 mix with neatly beveled edges and all surfaces rubbed smooth prior to mounting equipment.

Moisten structural slabs below pads and curbs and apply a sand-cement grout before pouring concrete.

All equipment provided with grout holes shall have voids filled with non-shrink grout after attachment to foundation.

11.19 Access Panels - Building: Where mechanical work is concealed in walls or ceilings, and is otherwise inaccessible, provide a hinged invisible type access panel complete with frame, sized and located to provide access for service and maintenance.

Minimum size of 12" x 12" for hand holes, 18" x 18" elsewhere.

Panels in acoustical tile ceilings shall be designed to accept tiles. Minimum size 12" x 24".

Mechanical work located above acoustical tile or metal pan ceilings, is considered accessible if the ceiling is arranged for access to the space above.

11.20 Escutcheons: Provide chromium-plated escutcheons of not less than 20 gauge steel sized to fit over insulation and to cover sleeves where exposed piping passes thru walls, floors and ceilings in finished areas; Grinnell 400 where sleeves extend above floor finish, Grinnell 10, elsewhere.

11.21 Valve Tags & Schedules: Provide numbered brass tags on all valves except at unit heaters. Numbers shall be not less than 3/4" high. Attach tags to valve stems with brass "S" hooks or brass chain.

Provide for each system a typewritten schedule of valves giving number and function of each with a small scale diagram outlining general run of pipe lines and location of valves.

Frame schedule and diagram under glass and mount in each applicable equipment room.

11.22 Identification of Piping: Identify piping specified under this division by banding with 5 mil thick, vinyl plastic tape and coding with stenciled legend as follows:

Diameter (Including Insulation)	Color Band Width	Size of Legend Letters
3/4 - 1-1/4"	8	1/2
1-1/2 - 2	8	3/4
2-1/2 - 6	12	1-1/4
8 - 10	24	2-1/2
Over 10	32	3-1/2

Legends shall be in full or abbreviated form, in contrasting color to background color. Where practicable, legends shall be on the lower quarters of the pipe.

Locate pipe identification as follows:

Mechanical Equipment Rooms:

Within 1' - 6" of each gate, globe, angle, or plug valve.

Within 3' - 0" of each 90° elbow, connection to equipment or vessel, point where pipe enters shafts and pierces outside walls.

On not over 20' intervals along all exposed piping.

Above suspended ceilings:

Within 1' - 6" of each valve or valve assembly.

At tees within 3' of both main and branch.

Within 3' of each 90° elbow.

Piping Concealed in Chases or Shafts:

Each pipe visible through an access door or panel.

Piping Exposed in Rooms other than Mechanical Equipment Areas:

Omit identification of piping, 1/2" and smaller, exposed at connections to equipment or plumbing fixtures.

With the above exception, identify at not less than 1 point each piping run visible in each room with identification on not over 20' intervals.

Schedule of Piping Identification:

Piping Systems and Contents	Band or Tape Colors	Stenciled Legends	Abbreviated Stenciled Legends
Drainage			
Vent	Green	Vent	V.

Heating			
Hot Water (Supply)	Yellow	H.W. Htg. Supply	S. Htg
Hot Water (Returns)	Yellow	H.W. Htg. Return	R. Htg
Miscellaneous			
Gas	Yellow	Gas	G

11.23 Painting: Except where otherwise specified, painting shall be done under another Section. Surfaces shall be left clean and free from oil.

Finishes of factory painted apparatus shall be touched up where finish is marred in installation.

Where galvanizing is broken during fabrication or installation, recoat exposed areas with cold galvanizing compound.

Exposed black iron pipe and supports exposed to view without removing ceilings or access panels shall be painted 1 coat of gray rust preventive paint.

Air conditioning units, exhaust fans and access doors shall be stenciled with system number in a prominent location with letters 2" high. Access doors shall also be stenciled to indicate equipment accessible there in.

All ductwork, conduits, insulation, pipe and structure visible through grilles and diffusers shall be painted flat black.

11.24 Heating, & Air Conditioning Testing, Adjusting & Balancing: Apparatus shall perform satisfactorily and pass any test necessary to show it is capable of meeting specified conditions. Furnish all labor and instruments for tests and adjustments.

Balance air systems and submit a report giving air quantities and velocities at each outlet and inlet based on anemometer or velometer readings.

Adjust grilles, registers and diffusers to give uniform diffusion of air throughout conditioned space.

Mark manual fresh air dampers at the point that gives the specified fresh air quantity.

Water piping, except PVC condensate drain piping, shall be water tested at 1-1/2 times normal working pressure, or 100 psi, whichever is greater for a minimum of 4 hours.

Gas piping shall be air tested at an air pressure of not less than 50 psi for a minimum of 4 hours.

The apparatus shall be lubricated and cleaned, the strainers cleaned, the stuffing boxes packed and made tight, and all automatic apparatus shall be adjusted.

Prior to acceptance and before final inspection, after adjustments are made, check all motors and submit a report listing for each motor:

Motor name and nameplate data.

Observed power input, volts, and amperes.

Rating of starter overload elements.

All tests of the piping systems shall be made in the presence of the Engineer or his representative.

After completion of the installation, the Contractor shall make all necessary adjustments and balance the system to provide uniform heating and cooling throughout.

PART 1: GENERAL - INSULATION

11.25 Description: The GENERAL PROVISIONS and Mechanical Systems are specified in other Parts of SECTION 11.

This part covers thermal insulation for equipment, duct and piping specified in Section 11.

Items Not To Be Job Insulated:

Piping installed in enclosures for:

Unit heaters

11.26 Definitions: Exposed piping is piping that can be seen when the building is complete without opening or removing access doors or panels.

Other piping is considered to be concealed.

11.27 Quality Assurance: Products of the manufacturers listed under MATERIALS will be acceptable for use for the specific functions noted. All materials shall be compatible with the materials to which they are applied, and shall not corrode, soften or otherwise attack such material in either the wet or dry state.

Materials shall be applied subject to their temperature limits. Any methods of application of insulating materials or finishes not specified in detail herein shall be in accordance with the particular manufacturer's published recommendations.

Insulation shall be applied by experienced workers regularly employed for this type work.

11.28 Rating: Insulation and accessories, unless specifically excepted, shall have a composite flame-spread rating of not more than 25 and a smoke developed rating of not more than 50. Materials that are factory applied shall be tested as assembled. Materials which are field applied may be tested

individually. No fugitive or corrosive treatments shall be employed to impart flame resistance.

Flame Spread and Smoke Developed Ratings shall be determined by Method of Test of Surface Burning Characteristics of Building Materials, NFPA No. 255, ASTM E-84, UL 723.

Products or their shipping cartons shall bear a label indicating flame spread and smoke developed ratings.

Treatment of pipe jackets and duct facings to impart flame and smoke safety shall be permanent. The use of water-soluble treatments is prohibited.

Vapor barriers shall have a perm rating of not more than .05 perms. Adhesives, coatings and mastics shall have a perm rating of not more than .25 perms.

11.29 Submittals: Certification prior to installation, that products to be used meet RATING criteria.

PART 2: PRODUCTS - INSULATION

11.30 Materials:

Fiber Glass Pipe Covering:

Certain-Teed
Johns-Manville
Owens-Corning Fiberglas
PPG

Adhesives and Mastics:

Foster
Childers
Epolux
Insul-Coustic/Birma
Monsanto
Owens-Corning Fiberglas
Vimasco

Preformed Fittings:

Insul-Coustic/Birma
Speedline Fittings

Insulating Cements: Asbestos free.

Eagle-Picher
Forty-Eight Insulations
Johns-Manville
Phillip Carey

Fiber Glass Duct Insulation:

Certain-Teed
Johns-Manville
Owens-Corning Fiberglas
PPG

Foamed Plastic Tubing and Tape:

Armstrong Cork
Certain-Teed
Johns-Manville
Owens-Corning Fiberglas
Pressite
Rubatex

PART 3: EXECUTION - INSULATION

11.31 Inspection: Surfaces to be insulated shall be clean, dry and free of foreign material, such as rust, scale and dirt when insulation is applied. Perform pressure tests required by other Sections before applying insulation.

Where existing insulation is damaged due to the new work, repair damage to match existing work or replace damaged portion with insulation specified for new work.

11.32 Application: Insulation shall be clean and dry when installed and during application of any finish.

Provide removable and replaceable covers on pumps and equipment that must be opened periodically for inspection, cleaning and repair.

Install insulation materials with smooth and even surfaces, jackets drawn tight and cemented down smoothly at longitudinal and end laps. Do not use scrap pieces of insulation where a full length section will fit.

Install insulation, jackets and coatings continuous through wall and floor openings and sleeves.

Banding wires shall have the twisted terminals turned down into the insulation, except where vapor barrier would be punctured.

Finish open ends of pipe insulation as specified for fittings.

Fill hollow steel pipe covering protection saddles with fiber glass insulation.

Staples are not permitted on pipe insulation.

Standing seams and other projections in ductwork or casings shall have insulation applied so that at least 1/4" of insulation will cover such projections.

Exposed covered ductwork less than 6" from ceiling or wall, shall be covered as specified, but finish shall be applied to join the ceiling or wall.

Where ductwork is lined, no thermal insulation is required.

Where unlined duct and lined duct connect, the insulation shall overlap lined section at least 4".

11.33 Insulation For Hot Pipe: Insulate pipe, fittings, flanges, unions and valves for:

		Insulation Thickness, inches		
		Up to 2"	2"4"	4" & above
HEATING				
Hot water	100 F to 200 F	1	1-1/2	2
	200 F to 240 F	1-1/2	2	2-1/2
Low pressure steam	Up to 250 F	2	3	3-1/2
AIR CONDITIONING				
Refrigerant hot gas & liquid		1	1-1/2	2

with preformed fiber glass pipe insulation of the thickness indicated and white foil-scrim Kraft jacket.

Install insulation with jacket drawn tight and side-laps and end joint butt strips secured. End joint butt strips shall be not less than 3" wide and of material identical to jacket.

Insulate fittings, flanges, unions and valves (including packing nut) with preformed or mitered fiber glass fittings of equal thickness and composition to adjacent pipe insulation. Wire fittings in place and cover with a smoothing coat of finishing cement. Finish with glass fabric embedded into a coat of mastic. Glass fabric shall overlap adjoining insulation at least 2". White fabric and mastic shall be used on exposed fittings.

11.34 Insulation For Hot Equipment: Insulate:

Boiler breeching including connections on boilers

In-line air separation tanks

Hot water compression tanks

with 1-1/2" 4# minimum density fiber glass board.

Secure insulation with copper-weld wire or galvanized bands. Miter or score blocks to insure tight joints. Seal joints with insulation cement. Apply 2" wire mesh securely to surface and finish with cement.

11.35 Insulation For Cold Pipe: Insulate:

Cooling coil drain lines

Refrigerant suction

Refrigerant liquid

Condensate drain piping

with preformed foamed plastic, 1/2" thick, slipped on before pipe joints are made up, held back from hot joints and joints cemented with contact adhesive.

Insulate fittings and valves with miter cut pieces of insulation, same thickness as piping.

11.36 Insulation For Cold Equipment: Insulate all refrigerant piping appurtenances subject to sweating, such as thermometer wells, gauge cocks, and valve stems with foamed plastic tape.

Foamed plastic tape shall be covered with glass fabric embedded between two 1/16" coats of mastic.

11.37 Insulation For Duct System: Insulate:

supply air ductwork

with flexible, fiber glass insulation, minimum thermal resistance of 5.5, or maximum "K" value of .27 at 75°F. mean temperature, with foil-scrim Kraft facing.

Butt edges and joints, secure 12" on center with copper clad, stainless steel or galvanized steel wire and vapor seal with tape or flanges adhered over the joints.

Seal all breaks and punctures with vapor barrier tape and adhesive.

On ducts over 3' wide, insulation shall be secured on the under side with mechanical fasteners on 18" maximum centers.

11.38 Weatherproofing: Protect insulation exposed to weather outside the building with .010" thick corrugated aluminum covers on piping up to 10", .016" thick on 10" and larger piping. Locate longitudinal joints to shed water and secure with 3 aluminum bands per section. Cover fittings with a layer of glass fabric embedded between two 1/16" coats of breathing mastic, overlapping adjacent aluminum at least 2".

11.39 Cement Finish: Cement finish shall be mineral wool cement not less than 1/2" thick trowelled to a smooth hard finish.

11.40 Description - Boiler: The GENERAL PROVISIONS and Mechanical Systems are specified in other Parts of Section 11.

This part covers boilers.

Provide a flexible, bent steel water tube type heating boiler where shown. The boiler shall be designed, built, inspected, tested and stamped for a minimum pressure of 150 PSI in accordance with the current A.S.M.E. Boiler Code for a working pressure of 30 p.s.i.g. water pressure.

The boiler; shall contain not less than the square feet of boiler heating surface shown and shall have a gross output load rating of not less than the BTU/HR with 80 percent minimum efficiency and shall be a Parker Model T or approved equal of capacity as shown on drawings.

The boiler shall be of the bent water tube design with tubes Grade SA-53 steel minimum O.D. of 1-5/16" and minimum wall thickness of .133" welded to top and bottom headers with high tensile weld metal. End of headers to have accessible inspection openings. Tubing shall be staggered to provide a minimum of 10 pass self baffled heating surface and designed with downcomers to provide internal self circulation. Tubes shall be of the bent design to permit free expansion and contraction. Mount boiler on a steel frame and enclose in a heavy steel cabinet with controls mounted. Boiler to be factory fire tested and approved by the Manufacturer before shipment.

The cabinet shall consist of two thicknesses of minimum 16 gauge steel insulated with a high temperature thermal fiber insulation minimum 1-1/2" thick. An inspection door shall be provided on the cabinet for accessibility to the burners and tubes. Cabinet shall be finished in a baked enamel heat resistant finish.

The burner shall be multiple cast iron up-shot self aspirating burners with fixed orifice requiring no wire adjustment. It must provide uniform heat distribution on all firing rates. The burner shall be for natural gas of 950 to 1150 BTU content and rated at 4" W.C. pressure at burner.

The boiler shall be finished complete with controls and trim to provide safe, efficient operation. Trim items furnished with the boiler shall include a draft diverter, safety relief valve, temperature pressure gauge, gas cock and gas pressure regulator.

These controls shall be furnished, mounted and wired on the boiler.

Operating and safety electric gas valves, dual operating temperature control, high limit temperature control and low water cutoffs. A float type primary combination low water cutoff and water feeder McDonnell Miller No. 51-2 shall be furnished. Mount external to the boiler at a safe system operating level and wired to terminals provided at the boiler. An auxiliary low water cutoff, McDonnell Miller No. 63-M, shall be mounted on the side of the boiler opposite the primary cut-off. The boiler shall be furnished with an enclosed boiler control panel with hinged door, boiler controls switch, and fuse for over-current protection. A Lite Sequence Indicator System with five indicating lights showing (1) control power on, (2) safe water level, (3) safe limit, (4) pilot on, (5) burner on, shall be provided. Primary electrical service to the boiler controls shall be 115 Volt, 60 Hertz, 1 Phase.

The burner shall be provided with the minimum number of constant-burning type pilots, as recommended by the burner manufacturer, to provide a safe and smooth burner light-off. The burner pilots shall be provided with electronic supervision of the primary pilot and thermo-couple supervision of each auxiliary pilot. The assembly shall include a Honeywell No. RA-890F electronic flame safeguard relay with 2 to 4 second response to flame failure and with 15 second shut-off of operating and safety gas valves in case of pilot failure, a Honeywell No. Q-179B flame rod modified for constant burning pilot applications for supervision of primary pilot, and BASO No. A-817F-11 pilot valve with thermo-couple on all pilots. All pilots shall be arranged so that they must be lit before the primary pilot is lit. The loss of any pilot shall cause a complete shutdown of the burner. The flame safeguard relay shall be mounted on a wood panelboard mounted on the wall.

The automatic gas safety valve shall be Honeywell No. V-4034A. The automatic operating gas valve shall be Honeywell No. V-4034A with parabolic plug guide, and the automatic normally open gas vent valve, shall be Automatic Switch Company No. 8210 provided in the gas manifold together with manual cocks, pressure regulators, and gauges.

The gas safety valve and operating valve shall each be wired in such a manner that both valves will be under the control of the operating controls, limit controls, and pilot flame sensing device, and the gas vent valve shall be wired so that valve will open when the operating and safety gas valves close and close when the gas valves open.

Gas appliance and pilot pressure regulators shall be provided for the boiler. Each regulator shall be of the spring loaded type for maintaining the required gas pressure at the inlet to the burner within ± 10% from maximum to minimum firing rates, with variations in inlet pressures not exceeding ± 40% of the rated inlet pressure. Each regulator shall be a minimum of 1/2" size.

Manual gas cocks shall be provided in the gas piping. Where lubricated plug cocks are indicated they shall be Rockwell Manufacturing Co. Fig. 114 for sizes 2" and smaller and Fig. 115 for sizes larger than 2", all other gas cocks shall be Crane No. 270. All gas cocks shall have operating handles attached in such a manner that they will be parallel to the gas flow when in an open position.

The manual cocks shall be spaced in the manifold to permit the cock lever handles to be parallel to piping when open.

A Honeywell, Inc. No. C-437H low gas pressure control switch with dampening orifice to prevent nuisance shutdowns for momentary low pressure surges, and manual reset feature, shall be provided in the gas piping to burner. The switch shall open automatically on pressure drop and shall be set at 2" W.C. gas pressure, and shall have a range of 1/2" to 5" W.C. Set the control point of the low gas pressure control slightly above the minimum safe light-off gas pressure as recommended by the manufacturer at the burner and pilot.

A Honeywell, Inc. No. C437D high main gas pressure control switch, requiring manual reset shall be provided in the gas piping to each burner. The switch shall open automatically on pressure rise. Switch shall have a pressure range of 1 to 27" W.C.

Set the control point of the high gas pressure control between that of normal incoming gas pressure entering the appliance regulator and that leaving, but not to exceed the maximum operating pressure recommended by the manufacturer.

Attention is called to the fact that all gas pressure switches must be installed exactly level.

A gas pressure gauge, Ashcroft No. 1188P, with 4-1/2" dial, and with range of 0" to 15" W.C. shall be provided in the gas piping.

A boiler mounted A.S.M.E. stamped approved side discharge pressure relief valve, with lever handle, sized for 1.25 times the A.G.A. input rating of the burner shall be provided on the boiler. The relief valve shall be Watts No. 740, or equal and shall be set for 30 P.S.I.G. pressure.

A Honeywell, Inc. No. L-6006A temperature controller with a range of 110°F. to 240°F. shall be provided to open and close the automatic gas valve electrically as required for the boiler to operate at 200°F. A high limit controller, Honeywell, Inc. No. L-4006E, with a range of 110°F. to 250°F., requiring manual reset, shall be provided on the boiler as limit controller, and shall close the automatic gas valves when the boiler reaches 240°F., the controller set point. Each controller shall have a separate connection to boiler.

A Honeywell, Inc. No. T-675A outdoor thermostat shall be provided with bulb in outside air to open each automatic gas valve electrically and start the hot water pump when the outside temperature falls below a predetermined set point and close each valve electrically and stop the hot water pumps when the outdoor temperature rises above a predetermined set point.

All unit controllers shall be 115 volts. All operating and safety controllers shall be in the hot side and one side of the operating coils shall be connected to the nuetral.

Each valve, control switch, etc., shall be properly labeled, with an adhesive backed plastic strip with letters stamped 3/8" high. Color of labels shall be red with white letters.

11.41 Boiler Alarm: Furnish an Edwards No. 872, 120 Volt "adaptahorn, or approved equal, for boiler burner, to signal boiler low water or flame failure conditions. Control contacts shall be provided in the burner control panel as hereinbefore specified.

11.42 Vent Connection: A Type "B" Metalbestos or Dura Vent connection of the size shown shall be run from the boiler through the roof. The vent shall be braced and supported from the building structure by means of steel strap supports.

The vents shall be assembled by using the method recommended by the manufacturer.

Flashing and couter-flashing shall be provided where vents pass through the roof.

The vent installation shall be in accordance with the regulations of the National Fire Protection Association.

11.43 Description - Heating: General Provisions and other Mechanical Systems are specified in other Parts of Section 11.

This Part covers Heating and Ventilation systems and equipment.

The heating system is designed to maintain an inside temperature of 65°F. when the outside temperature is 17°F.

11.44 Quality Assurance: Piping systems shall meet requirements of the applicable sections of the A.S.M.E. Code and the ANSI Code for Pressure Piping.

Pressure/temperature ratings of all components shall meet or exceed design conditions for the system in which they are installed.

Install the gas system to conform to AGA and NFPA requirements, and rules of the Gas Company.

11.45 Excavating: Do not excavate below the required depth. Backfill with loose, dry dirt, thoroughly tamped. Rock encountered shall be excavated 3" below the bottom of the pipe and the space so formed refilled with clean dry earth well compacted.

11.46 Boiler Operating Conditions: The fuel to be used for Boilers will be natural gas.

The natural gas will have a minimum heat value of 1000 BTU per cubic foot at a 7" w.c. minimum pressure, and 60°F. and a specific gravity of 0.6.

11.47 Gas Vent Piping: Provide vent piping from the relief opening of each gas pressure regulator and gas pressure switch to a point outside the building at least 10 ft. above finished grade, and at least 5 ft. from any building opening. The vent connection to each regulator or switch shall be increased when 2 or more appliances have been connected so that the common vent will be equal or greater than the sum of the cross sectional areas of all individual vents involved. The common vent shall be a minimum of 3/4" size. Attention is called to the fact that the vents from regulators in high pressure gas piping, above 1/2 psig., shall each be run independently to the exterior.

Install a vent line, with a normally open electrically operated vent valve as hereinbefore specified, connected to the gas main and run to a point outside the building at least 5 ft. from any building opening and at least 10 ft. above finished grade.

Terminate vent lines with an O.P.W. #113 flash arrestor.

The vent line from the pressure regulators and switches shall not be common with the vent line from the gas main.

11.48 Gas Pressure Regulators: Provide self-contained, balanced diaphragm, gas pressure regulators complete with "O" ring disc, bevel faced seat ring and minimum lock-up with either high or low inlet pressures. Each regulator shall be capable of delivering that quantity of natural gas at the pressure as noted on the drawings.

Each regulator shall be Rockwell, Maxitrol or Fisher.

11.49 Feed & Drain Connections: From an outlet in the water supply piping, in the Boiler Room make a 3/4" feed connection to the boiler and from an outlet indicated in the return piping provide a 3/4" drain pipe with 3/4" brass drain cock with hose thread, lock shield and loose key.

11.50 Water Pressure Regulating Valves: Regulating valves shall be 3/4" size and shall be adjustable and shall be capable of reducing city water pressure from 80 psi. to 15 psi. Regulating valves shall be Taco or A.W. Cash Type "E".

11.51 Compression Tank: A.S.M.E. stamped for 125 psi working pressure suspended from the structure above by means of suitable framing; J.J. Finnigan, or Taco.

Automatic air vent valve: Dole #75, Sarco #13W or Fisher #30, approx. 3" above bottom of tank. Extend discharge to a point near the floor.

Drain connection: 1/2" with gate valve with hose end nipple.

Piping: grade up to the tank 1/2" in 5 feet. Provide a square head cock, without handle, in the compression tank line.

Provide Armstrong or Taco, air control tank fitting with manual vent and vent tube on the compression tank.

11.52 Air Control Fitting: Provide in the flow line leaving the boiler, an Armstrong or Taco air control boiler fitting. Install the fitting using a short nipple, with the dip tube inserted in the boiler to a point so that only bubble free water will be circulated to the system. The end of dip tube must be beveled to assure unrestricted water flow.

Provide a 3/4" drain with valve on the separator tank.

Air control fittings shall be installed in accordance with the manufacturer's instructions.

11.53 Hot Water Circulating Water Pumps: Provide bronze fitted centrifugal in-line pumps having mechanical seals and suitable for operation with water at 220°F. Select units such that motor nameplate horsepower will not be exceeded at any point on the curve. Castings shall be designed to withstand a working pressure of 125 psi.

Pump shall be equipped with a 1750 RPM drip-proof, resilient-mounted, sleeve bearing motor of the size scheduled.

Pump shall be designed for quiet operation and shall have the capacities as scheduled.

Pump shall be Armstrong, or Taco.

11.54 Pump Controls: The outside thermostat hereinbefore specified for the boiler shall also be wired to shut-off the pump when the outside temperature exceeds the preset point of the control.

11.55 Flow Control Valves: Provide Armstrong or Taco flow control valves to prevent the circulation of water through the systems when the pumps are not running.

11.56 Air Relief Cocks: Provide a manual 1/8" air relief cock, Dole #10, or equal, Crane or Consolidated Brass Company in an accessible location at each high point in the piping system and on each upfeed unit heater.

Omit air cocks where automatic air relief valves are provided.

11.57 Air Relief Valves: Install automatic air relief valves in an accessible location at high points where shown on the drawings or as specified. Provide a gate valve in each connection. Extend valve discharges to floor drains,

unit drain pans or shall extend through the building wall and terminate 18" above grade with elbow on end turned down where so noted, or to locations noted on the drawings.

Air vent valves shall be Dole #75, Sarco #13W, Fisher #30, or approved equal.

11.58 Thermometers: Provide 5" dial thermometers with separable sockets. Thermometers shall have white anti-parallax dials with black figures, polished stainless steel cases and bayonet rings, and 1/2" lower or back connection as required. Range shall be of such as to provide approximate mid-point indication at normal operating temperatures. Each thermometer shall be Ashcroft Series AH, or equal Marshalltown, or Moeller, and shall have a guaranteed accuracy within 1% of the entire range.

11.59 Thermometer Test Wells: Provide 3/4" NPT steel test wells with screw plug and chain, for use with thermometers. The wells shall be mounted at eye level, and when installed in insulated lines shall be provided with an adequate extension neck. The wells shall be Ashcroft #39, or equal, Marshalltown or Moeller and shall be interchangeable with thermometer separable sockets.

11.60 Gauges: Provide Ashcroft #1020A, or equal Duro or Marsh standard pressure gauges. Gauges shall be of the bronze bourdon Tube Type with 4-1/2" white dial, black lettering, 1/4" lower connection, stainless steel case. Dial ranges shall be as listed below, with adjustable micrometer pointer.

SERVICE	RANGE
Hot Water	0-60 pounds

Provide a syphon and shut-off cock for each gauge. Syphons shall be 1/4" I.D. minimum and of non-ferrous construction. Shut-off cocks shall be Ashcroft Type 1095, or equal Duro or Marsh.

Provide gauge cocks of the type specified above with cap at the inlet and outlet of each heating coil.

11.61 Unit Heaters: Install unit heater as high as possible using steel hangers.

Capacities shall be based on 60°F. entering air and 190°F. average water.

Fan motors shall be single speed and wound for 120 volts, single phase, 60 cycle current.

Provide for each unit heater a manual thermal overload switch, Allen-Bradley Bulletin 600, or equal, and a line voltage thermostat adjustable from 50°F. to 80°F.

Provide a heavy duty metal protective guard for each unit heater thermostat.

Provide horizontal and vertical deflector vanes on horizontal discharge unit heaters.

Heaters shall be Modine, Trane, or equal.

11.62 General For Heating Piping: Where anchors are noted secure the piping to the building structure with rigid angle iron frames welded to the pipe.

Anchor vertical risers at their mid-points.

Arrange piping to minimize stresses caused by expansion and contraction.

Expansion in the lines shall be taken up by means of expansion loops and offsets.

Make connections to heating equipment as shown on drawings.

Install piping so as to preserve access to all valves, air vents, and other equipment and to provide the maximum headroom possible.

Install exposed piping such that when covering is applied it will not come in contact with adjacent surfaces.

11.63 Hot Water Flow & Return Piping: Flow and return mains and all horizontal piping shall pitch up in the direction of flow uniformly 1/2" in 40". Arrange piping for the proper venting of air and for drainage of all parts of the system. Take branches from the sides or bottoms of the mains.

Use eccentric fittings when changing size of horizontal piping keeping the tops of the pipes in line to permit free passage of air.

At each low point of the system provide a 1/2" valve with hose thread, and at each high point of flow and return mains provide an automatic air vent valve with 1/4" discharge line extended to the exterior of the building or to floor drains, as indicated.

Provide balancing fittings in the return connection to each unit heater and wherever else necessary to provide a means for properly balancing the system.

Provide manual air vent cocks on each unit heater enclosure where bottom supply and return connections are provided.

11.64 Pipe & Fittings: Hot water flow and return piping, except as hereinafter specified, shall be schedule 40 ASTM A-120 black steel pipe with cast iron screwed fittings, ANSI B16.4, 125LB. class, up to and including 2". Fittings larger than 2" shall be black steel butt welded type of a service class to match the adjacent pipe, except that connections to valves and equipment shall be made with flanged fittings, 125LB. class, conforming to ANSI B16.1. Companion flanges shall be forged carbon steel ASTM A-181, Grade 1, 150LB. class, flat face slip-on or welding neck type, conforming to ANSI B16.5. Flanges shall have bolts with hexagon heads and nuts and shall be made up with gaskets as specified under PIPE JOINTS.

Except as hereinafter specified, all gas supply and vent piping shall be schedule 40 ASTM A-120 black steel pipe with black banded malleable iron screwed fittings, ANSI B16.3, 150LB. class, up to and including 2". Fittings

larger than 2" shall be black steel butt welded type of a service class to match the adjacent pipe except that connections to valves and equipment shall be made with flanged fittings, 150LB. class, conforming to ANSI B16.5. Companion flanges shall be forged carbon steel ASTM A-181, Grade 1, 150LB. class, slip-on or welding neck type, conforming to ANSI B16.5. Flanges shall have bolts with hexagon heads and nuts and shall be made up with gaskets as specified under PIPE JOINTS.

Underground gas piping shall be wrapped with Johns Manville "Trantex V-20" pipe wrapping tape overlapped 50 per cent.

Gas pilot main piping shall be black steel as specified above, but pilot branch piping from connections from regulators and switches to vent mains as shown on the drawings shall be seamless copper tubing of standard type "K" or "L" complying with ASTM Specification B 88-62, with flared type brass fittings. Aluminum tubing shall not be used.

Cold water make-up piping, air vent discharge piping, boiler relief valve discharge piping, and hot water piping installed in unit heater enclosures shall be type "L" hard drawn copper conforming to the latest ASTM designation B-88, with wrought copper sweat fittings, made to ANSI B16.22, meeting ASTM B-75.

Drain piping shall be schedule 40 ASTM A-120 galvanized steel pipe with galvanized cast iron screwed drainage type fittings ANSI B16.12, 125LB. class. Changes in direction shall be made with 45° "Y" type fittings with brass screw plug cleanouts.

Synthane, Universal, or EPCO dielectric couplings shall be provided for connecting steel and copper piping.

Provide a union in the connection to each valve and piece of apparatus so that it may be readily removed without cutting the pipe.

Unions in black steel piping 2" and smaller, except as hereinafter specified, shall be black malleable iron, ground joint, bronze seated of the service class to match the adjacent piping, with screwed end connections. Unions in galvanized piping shall be same as above except that unions shall be galvanized.

Unions in black steel piping 2-1/2" size and larger, except as hereinafter specified, shall be flanged pattern of the service class to match the adjacent piping. Unions in galvanized piping shall be same as above except that unions shall be galvanized.

Unions in copper piping shall be cast brass or bronze with copper soldered connections.

Strainers shall be provided in the inlet to each pump, automatic control valve, and elsewhere as indicated. Strainers shall be of the "Y" type and shall have stainless steel, monel metal, or bronze basket screens, with the area of perforations of not less than 2 times the internal area of the pipe in which the strainer is installed. Strainers up to and including 2" size shall have iron body, screwed connections and 1/16" perforations in screen. Strainers

2-1/2" size and larger shall have iron body, flanged end connections, 1/8" perforations in screen, and shall be provided with a 3/4" gate valve and a hose-end threaded nipple blowdown. Strainers shall be designed for 125 psig WSP.

Strainers 2" and smaller shall have screwed ends, 2-1/2" and larger shall have flanged ends.

11.65 Pipe Joints: Make screwed joints in steel piping with teflon tape unless otherwise specified. Threads shall be clean cut and tapered; not more than 2 threads shall show when joint is made tight. Ream burrs from inside of the pipe, turn pipe on end and knock out all loose dirt and scale.

Nipples having less than 1" between threads shall be extra strong. All threaded nipples are not permitted.

Flared joints shall be uniform and free from cracks or flaws and shall be fully flared with flaring tool.

Make flanged joints, except in gas piping, with 1/16" thick, ring type, compressed asbestos composition sheet gaskets. Make flanged joints in gas piping with aluminum "O" ring gaskets. Gaskets shall extend to inside of bolt holes. Bolts and nuts shall conform to applicable portions of ASTM Standards A-194 and A-307.

Welding shall be in accordance with procedures of the National Certified Pipe Welding Bureau and shall comply with the requirements of the ANSI Code for Pressure Piping, B31.1. Welders shall be qualified under the above procedures and certified by the National Certified Pipe Welding Bureau or other recognized testing authority.

Make changes in direction and pipe size, and intersections of lines with fittings.

Where branches 2 or more sizes less than the size of the main are taken off, the mains may be burned out and welding nipples similar to Weldolet made by Bonney Forge Company used.

Make sweat joints in copper piping with tin antimony 95-5 solder and a petroleum base flux, as recommended by the manufacturer of the pipe.

Heat shall be applied to the fitting in such a manner as not to overheat the fitting.

11.66 Valves & Traps: A Sarco Type "IBV", or equal, combination balancing, indicating, and shut-off valve shall be provided in the return connection to each unit heater and elsewhere as required to balance the piping system, in piping 1-1/4" and smaller. Valves shall have brass body, suitable for 125 psi. and 230°F. operating temperature, and shall be complete with a full turn balancing device lockable in any desired position. Valves shall provide tight shut-off and be repackable under pressure, and, shall be provided with visible indicating dial showing "balanced" position of valve at all times. Other balancing valves shall be of the square head cock type as hereinafter specified.

Provide gate, globe and check valves throughout the piping systems where shown and where necessary to properly regulate and control the systems. Valves shall be the full size of the lines and shall be designed for low pressure drop. Gate and globe valves shall have provision for repacking when open and under pressure. Check valves shall be horizontal swing check type with regrinding seats and rotating discs. Check valve hanger pins shall be supported at both ends by removable side plugs.

Gate, globe and check valves shall be Crane, Jenkins Bros., Lunkenheimer, Pratt & Cady, or Kennedy, and all valves shall be of the same manufacture.

Except as otherwise specified, balancing cocks shall be Rockwell or DeZurik.

11.67 Description - Air Conditioning: General Provisions and other Mechanical Systems are specified in other Parts of Section 11.

This Part covers Air Conditioning Systems and equipment.

11.68 Design Conditions:

SUMMER	System S-1
Inside D.B.°F. & %R.H.	75-50
Outside D.B.°F. & W.B.°F.	95-78
Int. S.H. BTU/hr.	47,159
L.H. BTU/hr.	2,000
Total Heat BTU/hr.	76,759
Tons Refr.	6.3
Coil cfm.	3,000
Ent. D.B.°F. & W.B.°F.	78-62.2
Supply Fan cfm.	3,000
S.P., Approx.	1-1/2
Motor HP.	1-1/2
O.A. Min. cfm.	400

WINTER	
Inside D.B.°F.	70
Outside D.B.°F.	10
Total Heat BTU/hr.	145,000
Coil cfm.	3,000
Ent. D.B.°F.	66.3

Supply and return connections shall be on the same end.

11.69 Air Cooled Condensing Unit: Factory assembled and tested, complete with prewired control center, hermetic motor, compressor, coil, fan, motors, and refrigerant piping, all housed in a factory finished, waterproof heavy guage, zinc coated or bonderized steel enclosure, designed for vertical discharge.

Capacity: 6.3 tons refrigeration when operating at a 40°F. saturated suction temperature, with 95°F. DB air entering condenser.

Compressor: Positive pressure lubrication system with reversible oil pump; vibration isolators; suction and discharge valves; oil filter and oil level sight glass crankcase heater; suction line strainer; and relief valve.

Condenser: Copper tubes and aluminum fins. Fans shall be protected with fan guards.

Control Center: Motor starting equipment; 60 second oil pressure switch; on-off switch motor thermostat; compressor lock-out reset circuit, to prevent rapid compressor cycling.

Unit: Carrier, Trane, York, or Climatrol.

11.70 Refrigerant Pipe & Fittings: Type "L" hard drawn copper tubing with sweat type fittings. Fittings 4-1/8" o.d. and smaller wrought copper. Larger fittings cast brass, hot tin-dipped inside and out.

Refrigerant stop valves shall be designed for refrigerant service. Install valves to isolate each condenser, compressor, and receiver. Valves shall be packless, as manufactured by Kerotest, up to and including 1-1/8", and larger valves may be seal cap type, as manufactured by Henry.

Install a filter dryer of the serviceable molded porous-core type, Sporlan "Catch-All", and a moisture and liquid indicator, Sporlan "See-All", ahead of each solenoid valve.

Expansion valves shall be Alco, Detroit, or Sporlan, thermostatic type with external equalizer connections and shall be adjusted for the superheat suited to the evaporator.

Install vibration absorbers by Packless Metal Hose, Inc., or equal, in each hot gas line at the compressor.

Isolate copper piping from all other metals with sheet lead to prevent electrolytic action.

Clean inside of refrigerant lines with methyl alcohol before assembly and take care thereafter to prevent flux and other foreign matter from being sealed in. Cut pipe ends square and deburr. Clean pipe and fittings with #00 steel wool. Make joints without burning, using 45% silver alloy solder and flux as made by Handy & Harriman, J.W. Harris Company or United Wire Company.

Test refrigerant piping, equipment, valves and fittings at a pressure of 245 psi on the low side and 300 psi on the high side by introducing refrigerant and dry carbon dioxide (CO_2) throughout the freon circuit. Bubble test joints with soap lather, clean joints of soap and leak-test with a halide torch. The system shall be pumped out and the entire circuit placed under 27" of vacuum and allowed to stand sealed off for a period of 8 hours, without noticeable loss of vacuum.

Secure approval of the time set for the vacuum test so an observer may be present.

Submit an affidavit signed by the Architect's representative and the Contractor's representative, stating they have witnessed and approved the de-hydration test.

Exposed copper refrigerant piping shall be cleaned bright with steel wool and varnished after installation.

The refrigerant piping diagram shown on the drawings is for estimating purposes only and shall be modified to suit the equipment furnished. Submit a refrigerant piping diagram, approved by the compressor manufacturer, for approval.

11.71 Refrigerant Receiver: Conform to the ASME "Code For Unfired Pressure Vessels" for pressures above 30 psi suitable for use with the refrigerant employed, 2 bullseye type sight glasses, 250LB. brass safety valve, and valved liquid inlet and outlet connections.

Capacity: entire refrigerant charge when 80% full.

11.72 Draw-Through Conditioning Units: Cabinet type, complete with fan, motor, V-belt drive, drive guard, cooling coil, steam heating coil, and filters, all housed in a finished casing with thermal insulation and drain pan. Functional components shall be readily accessible for inspection and maintenance.

Fans: double inlet, centrifugal type, outlet velocity not exceeding 1600 fpm, tested in accordance with AMCA Standards.

V-belt drives: adjustable, sized to transmit 150% of motor horsepower. Drives for motors less than 3 HP shall be Woods FHP Variable Pitch V-Pulley. Drives of motors 3 HP and larger shall be Woods SVS Variable Speed Sheave.

Coils: copper tubes, non-ferrous fins, supply and return connections on the same end as specified under "COILS".

Cooling coils: DX, arranged for counter flow of cooling medium to air, face velocity not exceeding 500 fpm.

Heating coil: steam, face velocity not exceeding 500 fpm.

Filters: 2" thick throw-away.

Filter: automatic renewable media type, American Air Filter "Roll-O-Matic" or Farr "Roll-Kleen" complete with drive, motor, reduction gear, linkage and adjustable electric time switch to periodically operate filter as specified under "FILTERS".

Drip pan and that section of casing embodying the fan and coil section shall be factory insulated to prevent external condensation. Pans shall be pitched toward drain outlet to prevent puddling of condensate in pan.

Casing insulation shall be fiber glass, semi-rigid board with vinyl coating on air side. All edges shall be coated with mastic to prevent erosion of glass fibers in the air stream.

Insulation in the air stream shall be 6 pcf density semi-rigid board fiber glass, secured to the metal casing with Graham-studs or Stick-clips spaced at least 1 for each 2 square feet, set in a heavy coat of adhesive, finished with a waterproof and fireproof coating applied to cover the entire surface and to fill all cracks of the insulation.

Insulation and finish shall have a composite flame spread rating of not more than 25 and a smoke developed rating of not more than 50.

Units shall be Buffalo, Clarage, Carrier, Trane, Westinghouse, York or Climatrol.

PART 1: GENERAL - AIR DISTRIBUTION

11.73 Description: General Provisions and Mechanical Systems are specified in other Parts of Section 11.

This Part covers air distribution systems and equipment.

Door grilles, louvered penthouses, gravity roof ventilators, gooseneck roof ventilators and vent bricks are specified in this Section but installation is specified in another Division.

Motorized dampers not furnished with equipment are specified in AUTOMATIC CONTROLS.

Air conditioning units are specified in AIR CONDITIONING.

11.74 Definitions: Sizes shown for lined ductwork are sheet metal sizes.

All ductwork shall be considered low pressure.

Door grille areas are indicated by circled numbers in door openings indicating minimum square feet of face area inside the grille frame.

PART 2: PRODUCTS - AIR DISTRIBUTION

11.75 Sheet Metal Work - General: Provide offsets, elbows, and transformations to coordinate with other work. Changes in shape or dimension shall be made with a maximum slope of 1 to 7.

Ducts over 12" in either dimension, except those to be insulated with rigid board, shall have all sides cross broken or machine formed transverse beads spaced not over 12" on center.

Elbows in supply and relief ductwork and on the discharge side of exhaust fans shall have an inside radius equal to the width of the duct, except where otherwise shown or necessitated by space conditions. Where inside radius is less than 3/4 duct width, provide multiple turning vanes. Square elbows shall be provided with turning vanes as manufactured by Tuttle & Bailey or Barber-Colman, or shop fabricated using runners and double vanes.

Elbows in return and outside air ductwork and on the suction side of exhaust fans shall be made with a 3" minimum throat radius and a full heel radius.

Set return, relief and exhaust grilles, except eggcrate ceiling type and layin type, of 30" or more greatest dimension, in 2" x 2" x 1/8" steel angle frames with corners mitered, welded and ground smooth.

Construct ductwork and apparatus casings of galvanized steel conforming to SMACNA recommendations.

Construct uninsulated ductwork exposed in finished areas with "S" and drive slip joints.

Construct ducts of galvanized steel of the following gauges:

Greatest dimension	U.S. Gauge
0" thru 12"	#26
13" thru 30"	#24
31" thru 54"	#22
55" thru 84"	#20
Over 84"	#18
Plenums	#18

Other Gauges are as indicated on the drawings.

Construct ductwork with standard drive slip joints.

Assemble rectangular duct sections with Pittsburgh lock, or grooved longitudinal seams. Button snaplock seams shall not be used.

Form pocket slips into a frame, riveted at corners, and assembled to duct section by clip punch.

11.76 Duct Lining: Line ductwork, as shown on drawings, with 1" thick, mat faced or coated, 3 pcf density, glass fiber duct liner.

Lining and accessories shall have a composite flame-spread rating of not more than 25 and a smoke developed rating of not more than 50.

11.77 Flexbile Connections: Neoprene impregnated glass cloth not less than 2" long in the inlet and outlet of centrifugal fans, and the outlet of air conditioning units.

11.78 Access Panels: Tight fitting, hinged, insulated type; Air Balance, Buensod, Cesco, Louvers & Dampers, Ruskin or Ventlock.

11.79 Flexible Ductwork: Provide low pressure factory insulated flexible duct between supply ductwork and air diffusers full size of connection, flame spread rating not over 25, smoke developed rating not over 50, Fiberglas, Genflex, Thermaflex or Wiremold.

Inner sleeves shall be fiber glass or Tedlar covered spring steel. Insulation shall be not less than 1" thick fiber glass with vapor barrier jacket.

11.80 Hangers & Supports: Hang horizontal duct by galvanized steel strap, 1/8" x 1" for ducts 48" or smaller, 1/8" x 1-1/4" on larger ducts with 1" hook turned under bottom of duct.

11.81 Splitter Dampers: Splitters shall be made of the same thickness galvanized steel as the duct, 24 gauge minimum securely attached to a rod at the air leaving edge and made of 2 thicknesses so the leading edge presents a round nose to air flow. Length shall be equal to 1-1/2 times the width of the smaller duct; 12" minimum.

Splitters 20" and smaller in both directions shall have 3/8" rods and bearings. Splitters over 20" in either direction shall have 1/2" rods and bearings.

Rods shall be cold rolled steel with slotted ends to show damper position. Rods shall not be drilled for attaching damper blades. Bearings shall be Duro-Dyne SB-138 or SB-112, Ventlok 607 or Young Regulator 656.

Splitters 24" and smaller in exposed or accessible ductwork shall have regulators with device for locking damper in position and marked frame showing damper position, Duro-Dyne SR-388 or SR-128 or Ventlok 641. In concealed and inaccessible ductwork, provide adjustable cover, concealed regulators, Ventlok 677 or Young Regulator 315, chrome-plated.

Splitters over 24" in either direction shall be anchored at the air entering edge with 5/16" adjustable rods that pass through clamps on the outside of the duct. Use 1 rod on splitters with leading edge up to 24"; 2 rods up to 60"; and 30" on center above 60". Clamps shall be Duro-Dyne SRP-516, Ventlok 603 or Young Regulator 950.

11.82 Multi Blade Dampers Blades shall be 16 gauge galvanized steel, mounted in steel frames by steel trunnions riding in self lubricating bronze bushings, interconnected to operate as a unit with opposed blade action. Blade width shall not exceed 12". Individual blade length shall not exceed 48". Where

damper is mounted inside ductwork, extend one trunion to permit operation of the damper from outside of duct. Rods shall be slotted to indicate damper position.

Manually operated dampers shall be provided with cadmium-plated steel quadrant with device for locking damper in position and marked frame indicating damper position, Duro-Dyne KL-7R or Ventlok 560.

Ferrous parts that are not galvanized shall be painted with 2 coats of Rust-Oleum, rust resisting paint.

Motorized dampers not furnished with equipment shall be furnished by the control manufacturer.

11.83 Automatic Shutters: Aluminum blades mounted in steel or aluminum frames, steel trunnions riding in self lubricated bushings, neoprene edged blades linked to operate as a unit and gravity adjustment to vary the operating pressure.

Provide 1/2" mesh galvanized wire screen in removable galvanized U-frame on room side of shutters.

11.84 Grilles, Registers & Diffusers: Supply grilles, registers and diffusers have been selected from the catalogue of one manufacturer. Check sizes with the performance of the manufacturer being furnished. With air introduced at 20°F. temperature differential, air shall be diffused at the 5 foot level to a velocity not greater than 30 FPM and a temperature differential not greater than 2°F.

Provide grilles and registers as follows:

Type	Agitair	Barber-Colman	Carnes	Titus	Tuttle & Bailey	Krueger
Supply grilles	DDV	92HV	250V	272	T-64	880
Supply registers	DDVO	92HVV	200V	272-5	T-647	880-OBD
Return and relief grilles	DG	94AH	650H	23	T70D	S-80
Return and relief registers	DGO	94AHOV	600H	23-5	T77D	S-80-OBD
Flangeless door grille cores	C	V	900	T-800	T-980V	600C
Flanged door grille	FS	GDV	930	T-800BF	T-980WF	600A

Supply grilles and registers shall have vertical front blades, return grilles shall have horizontal blades.

Grilles and registers with borders shall have felt or rubber gaskets cemented to the back face and holding screws not over 18" on centers around the perimeter.

Grilles passing air through partitions shall be as described for wall return grilles, 1 for each side of partition.

Return and relief grilles and registers in ceilings shall be 1/2" x 1/2" x 1/2" fabricated aluminum louvers with extruded aluminum flanges. Grilles in push-up type acoustical tile ceilings shall be furnished without flanges, and shall be sized to fit into the inverted "T" ceiling suspension system.

Flanged return air grilles to above ceilings shall have hinged cores for access.

Exhaust registers shall be 1/2" x 1/2" x 1/2" aluminum eggcrate.

Register dampers shall be of the gang-operated, opposed blade type, operated through the face of the register. Operating mechanism shall not project through the register face.

Provide ceiling diffusers as follows:

Type	Agitair	Barber-Colman	Carnes	Titus	Tuttle & Bailey	Krueger
Square Perforated Plate for Surface Mounting	EPS	PBS	43002	TXS-1	CTE	1100
Square, Volume Control Damper	Flexitrol	500V	43	AG-95	No.7	OBD

Diffusers shall be complete with straightening vanes, and where noted "VCD", volume control dampers.

Internal parts of diffusers shall be secured so they can be removed and assembled without special tools.

Steel grilles and registers shall be finished in light neutral color baked enamel, Barber-Colman Gold Tone Gray or Titus Off White.

Ceiling diffuser face and frame shall be finished in off-white baked enamel; interior flat black.

11.85 Fans - General: Provide fans rated according to the AMCA Standard Test Code.

V-belt drives shall be adjustable, sized to transmit 150% of motor horsepower. Drives for motors less than 3 HP shall be Woods FHP Variable Pitch V-Pulley. Drives for motors 3 HP and larger shall be Woods SVS Variable Speed Sheave.

11.86 Propeller Fans: Steel construction with inlet fan guard, square mounting plate, streamline inlet ring, motor and V-belt direct drive; Acme, Buffalo, Carnes, Carrier, Cook, Coolair, Greenheck, Ilg, Jenn-Air, Penn, Peerless or Trane.

All fans shall be equipped with motorized shutters.

11.87 Wall Exhausters: Aluminum construction with mounting ring isolated from motor and wheel, direct connected motor; Carnes, Cook, Greenheck, Ilg or Jenn-Air.

11.88 Power Roof Ventilators: Centrifugal type of aluminum or plastic construction complete with motor, drive, birdscreen, backdraft damper, disconnect switch, prefabricated curb and curb cap: Acme, Carnes, Cook, Greenheck, Ilg, Jenn-Air, or Penn.

Curb for range and grille hood exhaust shall be twin-shell insulated type.

PART 3: EXECUTION - AIR DISTRIBUTION

11.89 Sheet Metal Work - General: Provide electrical outlet access plates where ductwork covers electrical outlet boxes.

Provide access panels for cleaning, oiling, inspection and maintenance.

Separate galvanized sheet metal from aluminum or copper with lead or felt gaskets.

Where pipes, hangers, and conduit pass thru ducts or sheet metal partitions, seal around opening after installation.

Provide supplemental stiffening on ducts and apparatus casings to prevent drumming and to provide a structurally sound assembly.

Interior of ducts shall be smooth with joints caulked or sealed with duct sealer. The entire air system installation shall be rigid, free from rattles and air noises.

Provide auxiliary frames set flush with the plaster line for outlets in plaster.

11.90 Plenum Lining: Install lining with fire retardant coating facing air stream. Adhere liner to inside of plenums with 100% coverage of adhesive. Coat exposed edges and joints with edge sealer. Turn edges of liner covering into liner. Attach liner and cover to plenum with mechanical fasteners, similar to Graham welded pins at max. 16" on center. Adhere liner to masonry with insulation hangers set in adhesive 12" on center.

11.91 Duct Lining: Install lining with coated side facing air stream. Adhere liner to inside of duct with 100% coverage of adhesive. Mechanical fasteners, similar to Graham welded pins shall be used at maximum 16" on center on top sections over 12" wide and side sections over 24" high. Coat exposed edges and joints with edge sealer. Protect leading edges against flaking by 24 gauge galvanized metal protectors.

11.92 Flexible Ductwork: Install flexible ductwork in a fully extended condition, free of sags and kinks, using the minimum length required to make connection. Seal joints with duct sealing compound.

11.93 Hangers & Supports: Support horizontal ductwork not more than 8' on center.

Where ducts are suspended directly from the structure, screw or pop-rivet hangers to the bottom and sides of the duct and secure to the structure with inserts, expansion shield bolts, powder driven studs, beam clamps, or welding.

Where ducts are suspended below ceilings, extend hangers through the ceiling and secure to the structure as specified above.

11.94 Grilles, Registers & Diffusers: Wall return and relief grilles installed above eye level shall be installed with blades angled so the inside of the duct or the adjacent space will not be visible through the grilles.

11.95 Throwaway Filters: Install a set of filters to be used while building is under construction. Upon completion of construction, these filters shall be removed and replaced with a new set.

PART 1 - GENERAL - AUTOMATIC TEMPERATURE CONTROLS

11.96 Description: General Provisions and Mechanical Systems are specified in other Parts of Section 11.

This Part covers Automatic Temperature Control Systems and equipment.

11.97 Related Work: The installation of motor starters that are not factory installed, thermal overload switches, remote push button stations and power wiring to motors, starters, thermal overload switches, contactors, electric heating coils, electric humidifiers and remote push button stations is specified in another Division. This Division includes mounting controls and all other automatic control, interlock and starting circuit wiring.

11.98 Quality Assurance: Installation shall be by trained mechanics in the employ of the Control Manufacturer.

11.99 Submittals: Diagrams: separate diagrams, for each system, including power supply through starters and motors; motor starting and interlock wiring; push buttons; all control wiring; interior electrical circuits of control instruments with terminal designations; control motors; colors of wires; locations of instruments and remote elements; horsepower of motors; normal position of valves, dampers and relays, etc. A detailed description of the operation of the control system including control device designations shall accompany the drawings. A copy of the appropriate approved diagram and description of operation shall be framed under glass and mounted near each system control panel.

11.100 Job Conditions: Visit the job site before bidding job, and make a survey of all existing control instruments. Re-use existing instruments that would be practical in the new system. Reused instruments shall be put in A-1 working condition and shall bear the same warranty as new instruments.

PART 2 - PRODUCTS - AUTOMATIC TEMPERATURE CONTROLS

11.101 Acceptable Manufacturers: Barber-Colman, Honeywell or Johnson Service

11.102 Materials:

(a) Thermostats: adjustable throttling range. Room type shall have blank covers and concealed means of adjustment. Remote element type shall have accessible adjustment knob, and be mounted on a vibration free surface, 5 feet above the floor unless specified to be mounted on a control panel. Provide separable wells for elements in liquids and extended necks for wells in insulated pipe.

(b) switches: potentiometer or multipoint type with accessible means of adjustment.

(c) Relays, transformers, fusestats, etc.: provide as required.

(d) Valves: bronze trimmed; 2 inches and smaller, bronze bodies with screwed connections; over 2 inches iron bodies with flanges. Steam and hot water valve sizes on drawings, chilled water valves line size.

(e) Dampers: as specified under MULTI-BLADE DAMPERS.

(f) Firestats: manual reset type.

(g) Motors: oil immersed gear train.

(h) Panels: separate panels for each Air Conditioning System; surface type cabinet with hinged front cover and cylinder lock.

Wire each control circuit thru the panel before going to the control device. Provide an individual terminal screw for each incoming wire. Separate line voltage terminals from the low voltage terminals.

Label each panel and piece of equipment in and on the panel. Labels shall be engraved laminated bakelite.

Provide on the panel a nameplate showing Architect, Engineer and Contractor.

Mount the following items on panels, locate other appurtenances inside panels:

(1) Thermometers showing outside, supply and return air temperatures

(i) Wiring: low voltage control wiring not less than #18 plastic covered, color coded. Line voltage wiring not smaller than #14 600. Run wire in conduit with outlet boxes and fittings as specified in the Electrical Division.

(j) Label control apparatus with engraved laminated bakelite labels or brass tags attached with brass "S" hooks, bearing functional designations as shown on the control diagram. Stamp letters into the tags and fill with black paint.

SECTION NO. 12

ELECTRICAL

12.01 Scope: The work covered by this Section of Specifications consists of all material, labor, equipment, plant, and appurtenances, for the modifications to existing aerial and interior electrical systems and the installation of new exterior and interior electrical systems as indicated and specified.

12.02 Existing Conditions: The Contractor in undertaking the work under this contract is assumed to have visited the premises and to have taken into consideration all conditions which might affect his work. No consideration will be given to any claim based on lack of knowledge of existing conditions except where existing conditions are such as cannot be readily ascertained. Any claims relating to conditions which were not readily ascertainable shall be adjusted as provided in the contract for changes in the work.

12.03 Power Outages: Portions of the work will require disruption of electrical service to certain items of equipment, in part or total, for either a momentary or prolonged period of time. Scheduling of power outages shall be as specified in Section 1, General and Detailed Requirements. Except as permitted for required power outages, continuity of electrical service to buildings and equipment shall be maintained at all times.

12.04 Alterations To Existing Work: Existing conduits, wiring, outlets, lighting fixtures, panels, and equipment shall be removed, relocated or abandoned as indicated. The existing installation is to remain except where otherwise indicated or specified. All work necessary to interconnect the new work with the existing work and to adapt the existing work to the changes in the structures and systems shall be performed.

Where conduits or equipment are indicated to be relocated or reused such materials shall be coordinated at the new location. Where conduits are indicated to be removed, this shall include all unused outlets, nipples, stubs through floors, and all unused equipment served by the conduit. Stubs extending from floors, ceiling, and walls, which cannot be removed shall be cut flush with the surface and the opening sealed.

Where conductors are indicated to be removed, they shall be removed in their entirety back to the overcurrent devices serving the conductors.

Where conduits are indicated to be abandoned, the conductors are to be removed as specified and the conduit sealed at both ends.

Where an area is indicated to have all unused conduits or equipment removed, the foregoing shall apply to all unused conduits, stubs, outlets, fixtures, and equipment in the defined area.

All unused openings in outlet boxes, junction boxes, and equipment shall be closed.

12.05 Codes: The following codes shall govern the installation of the work:

National Electrical Code - 1975 Edition

National Bureau of Standards Handbook 81, 1961 Edition

Georgia Public Law No. 525 - 1960 "Installation, Etc., of High Voltage Lines".

City of Athens, Georgia Electrical Code

12.06 Materials & Standards: Standards of the following organizations will be referred to by abbreviations. These standards set the minimum standard for all materials used in the work. Where these standards are amended by the project specifications, such amendments shall be incorporated in the product.

U.L. - The Underwriters' Laboratories, Inc.

N.F.P.A. - National Fire Protection Association

A.N.S.I. - American National Standards Institute

N.E.M.A. - National Electrical Manufacturers' Association

I.E.E.E. - Institute of Electrical & Electronics Engineers

I.P.C.E.A. - Insulated Power Cable Engineers Association

A.E.I.C. - Association of Edison Illuminating Companies

All electrical materials shall be new and listed by the Underwriters' Laboratories, Inc., shall meet their requirements and shall bear their label wherever standards have been established and label service is regularly furnished by this agency.

Where standards have not been established by the Underwriters' Laboratories and label service or certification service is not available, the manufacturer shall certify that the material has been manufactured, assembled, and tested in accordance with the applicable standards specified.

References to catalog numbers, trade names, brand names, or the names of manufacturers, made in the specifiations or indicated on the drawings are made to designate and identify the quality of the product to be furnished and are not intended to restrict competitive bidding. Similar products of equal quality, capacity, and character by the same or other manufacturer may be substituted provided that application for the approval of the use of such products must be submitted to the engineer at least ten days prior to the bid date.

12.07 Data To Be Submitted: Contractor shall submit six copies of descriptive literature and comprehensive drawings for approval prior to fabrication. Drawings shall be complete in all detail, and reflect in a composite manner, the entire assembly proposed to be furnished by the manufacturer. Computor "print-outs" are not acceptable.

Drawings and descriptive literature are required for:

Pad Mounted Transformer
Switchboards
Distribution, Power, and Lighting Panelboards
Motor Controls

Descriptive literature only is required for:

5KV cables
600V wire and cables
Multi conductor control cable
Safety and disconnect switches
Fuse cutouts
Individual mounted circuit breakers
Lighting fixtures
Wiring devices
Lightning arrestors
Conduit and conduit fittings
Cast iron junction boxes
PVC conduits

12.08 Guarantees & Tests; The installation shall be entirely free from improper grounds, short circuits, or other defects. All wiring shall have dielectric strength between conductors and between conductors and ground of not less than the value recommended in the National Electric Code. All tests shall be made in the presence of the Engineer or his authorized representative. The Contractor shall furnish assistance in performing these tests as required by the Engineer.

All protective equipment shall be operated to show it is in proper operating condition.

All control systems shall be checked for correct operation.

12.09 Connections To Motors, Equipment, & Apparatus: Electrical power, control, and status wiring to operate the motors, equipment, and apparatus for the electrical, mechanical, and process systems shall be furnished and installed as indicated.

Certain motor control devices are specified to be furnished under other Sections of the Specifications. Control devices indicated on the drawings and not specified to be furnished by other Sections shall be furnished under this Section. All electrical control devices, except as specified in Section 10, are to be installed and connected under this Section.

12.10 System Voltage: The aerial distribution system is a nominal 2400V., 3 phase, ungrounded delta system.

The building system voltage will be a nominal 208/120 volt, 4 wire, 3 phase, solidly grounded wye.

Lighting equipment, except H.I.D. lighting or where indicated on the drawings, will operate at 120 volts.

Motors 1/2 H.P. and larger shall be 200 volt, 3 phase, 60 Hertz. Motors smaller than 1/2 H.P. shall be 120 volt or 200 volt, 1 phase, 60 Hertz.

Other loads larger than 3 KW shall be designed for 208 volt, 3 phase operation. Loads 3 KW or smaller shall be designed for 120 volt or 208 volt operation.

12.11 Grounding: Minimum requirements for grounding shall be National Electrical Code.

Feeder conduits shall contain a code sized grounding conductor, in addition to the phase conductors and neutral. This conductor shall be attached to the frame of the equipment served on the load end of the conduit, and shall be electrically continuous to the ground bus in the main switchgear. All panels shall be equipped with a copper ground bus, bonded to the enclosure, with lugs to accommodate all grounding conductors entering the panel.

Locknut connections to cabinets, pull boxes, and junction boxes shall be wrench-tight, with locknut projections driven into the opposing metal surface.

A bonding jumper shall be installed inside of all flexible conduit on all lighting and other branch circuits operating at more than 150 volts to ground which does not otherwise have a grounding conductor. Jumper shall bond from outlet box at origin of flexible conduit to outlet box or equipment at its termination. Bonding jumper shall be sized in accordance with NEC Table 250-95.

Ground conductors shall be Type THW, green colored, and of size as indicated on drawings.

Contractor shall make no ground connections except as required by the National Electrical Code or as specified or shown on the drawings.

12.12 Nameplates: Each circuit breaker, panelboard, disconnect switch, motor starter, motor overload switch, or other devices shall have an identifying nameplate affixed, such as "PANEL PA", "FAN S-2 STARTER". Nameplates shall be laminated plastic, white engraved letters on black background. Letters shall normally be 1/4 inch high. Embossed taped strips are not acceptable.

12.13 Power & Distribution Panels: Power and distribution panels shall be of dead-front panelboard construction. Boxes shall be formed from one piece of Code gauge galvanized steel. End pieces shall be seam welded to the back and sides. Boxes shall be furnished without knockouts. Doors shall be provided with an over-sized directory which clearly indicates the use of the circuit. Doors shall have piano type hinges and flush catch and lock.

Bus shall be copper bus bars of 98% conductivity, silver plated at all joints and connection points. Lugs shall be copper or copper alloy for copper conductors only.

An insulated, groundable, neutral bar shall be provided in each panel.

A ground bus, with lugs for each breaker, shall be bolted to the box.

Top and bottom gutters shall be not less than 10 inches wide. Side gutters shall be not less than 8 inches wide at the narrowest point.

Panelboards shall be of the dead front convertible distribution panel type.

Overcurrent devices shall be molded case, thermal-magnetic, circuit breakers with trip ratings and number of poles as shown on the drawings. Interrupting capacity shall be not less than indicated by frame sizes or RMS symmetrical ratings shown on the drawings.

Breakers rated over 150 amperes shall have interchangeable trips.

Breakers shall be interchangeable at any location in the panel.

Single pole and two pole breakers with pre-determined fixed phase connections are not acceptable.

Panelboards shall be designed for continuous duty.

Panelboards enclosures shall be as scheduled on the drawings.

Panelboards shall be constructed in accordance with UL-67-August 1974 Rev. October, 1975, and NEMA PB-1, May 1971 Rev. August, 1975.

Panelboards shall be manufactured by General Electric, I.T.E., Westinghouse or Arrow-Hart.

12.14 Lighting Panels Lighting panels shall be formed from one piece of code gauge galvanized steel. End pieces shall be welded to the back and sides. Boxes shall be furnished without knockouts. Doors shall be provided with a type written oversized directory which clearly indicates the use of the circuit. Flush mounted panels shall have doors with concealed hinges, flush catch and lock. Surface mounted panels shall have doors with piano type hinges and flush catch and lock.

Gutter space shall be not less than 4 inches on all sides. Cabinets shall be not less than 20 inches wide except where indicated.

All buswork shall be of copper of 98% conductivity silver plated at all joints and connection points. Lugs shall be copper or copper alloy for copper conductors only.

Overcurrent devices shall be molded case, thermal-magnetic, circuit breakers with trip ratings and number of poles as shown on the drawings. Interrupting capacity shall be not less than indicated by frame sizes or RMS symmetrical ratings shown on the drawings.

Breakers shall be interchangeable at any location in the panel. Single pole and two pole breakers with pre-determined, fixed phase connections are not acceptable.

Panelboards shall be designed for continuous duty.

Panelboard enclosures shall be as scheduled on the drawings.

Panelboards shall be constructed in accordance with UL-67 - August 1974, Rev. October 1975, and NEMA PB-1 May 1971, Rev. August 1975.

120/240V, 1 phase, and 120/208V, 3 phase panelboards shall be type NLAB.

Panelboards shall be manufactured by Arrow-Hart, G.E., I.T.E., or Westinghouse.

12.15 Motor Control: Furnish and install all motor control devices, excluding devices designed for low-voltage operations, for the Air Conditioning, Heating, Ventilation, Plumbing, and Process Systems except for those devices specified to be furnished as a component with the equipment to be controlled.

Motor control devices specified to be furnished in other sections of the Specifications shall be installed and electrically connected and tested.

Motor control devices are to include motor starters, contactors, relays, thermal overload switches, pilot lights, push-button stations, selector switches, safety switches, and disconnect switches.

Other control devices such as thermostats, fire stats, pressure switches, float switches, electrically controlled valves, low voltage controls, and special control panels specified to be furnished in other sections of the specifications shall be installed and electrically connected and tested.

All motor starters, contactors, and control panels shall be furnished with an integral circuit breaker installed on the line side of the control device. Frame size and trip rating of the breaker shall be as indicated on the drawings. An external operating handle capable of being locked only in the "OFF" or "OPEN" position shall be provided. Unit covers shall be interlocked with the circuit breaker operating handle to preclude opening of the cover door when breaker is closed. The interlock shall be provided with a defeater device.

All motor control devices, where the neutral conductor of the 120/208 volt system is not available, shall be provided with individual 208:120 volts controls power transformers for operation of holding coils and associated controls devices. It is the intent and requirements of these Specifications that no motor control voltage be higher than 120 volts. Controls power transformers shall be of capacities for loads served. Each transformer shall be fused on the secondary side with readily accessible fuses.

Unless otherwise scheduled or indicated, motor control (starter) unit shall be general purpose magnetic units, full voltage, non-reversing, with three relays (heaters), one in each phase of the motor branch circuit. Minimum size of starters shall be NEMA Size 1.

Each starter unit shall be provided with at least three sets of auxiliary control contacts, with provision for adding additional contacts.

Each starter unit shall be provided with an H-O-A selector switch mounted in front of unit, unless otherwise scheduled.

Each starter unit shall be provided with a red push-to-test pilot light mounted in front of unit. This light shall be on when starter is in closed (running) position.

All pushbuttons, selector switches, and pilot lights installed in the covers of control devices shall be oil-tight.

All remote mounted push buttons selector switches, and pilot-lights shall be of the heavy duty oil-tight type. Pilot lights shall be push-to-test transformer type.

Enclosure for motor starters, contactors, and relays shall be as follows:

Indoors - NEMA - 1A

Indoors, where noted - NEMA 12

Outdoors - NEMA - 4X and NEMA - 4SS

Overload devices (heaters) shall be field installed and properly sized from actual motor nameplate data. The setting shall be decreased where the actual voltage is greater than the nameplate voltage.

Motor Control Devices shall be in accordance with U.L. Standard U.L. 508, Rev. June, 1976 and A.N.S.I. Standard C33.76-1971.

Motor control devices shall be manufactured by Allen-Bradley, Furnas, G.E., Square D, or Westingouse.

12.16 Safety & Disconnect Switches: Fusible safety switches and unfused disconnect switches shall be installed where indicated on the drawings.

All fused and unfused switches shall be heavy duty. Disconnect switches for motor circuits shall be horsepower rated. Where indicated by the symbol "MSS" on the drawings, disconnect switches shall be an externally operated switch designed to circuit breaker specifications. For small loads up to 2 H.P. or other loads up to 20 Amps., a toggle type H.P. rated motor switch may be used.

Enclosures shall be NEMA 1 for general indoor use, NEMA 12 for indoor use in Chemical storage or treatment areas, and NEMA 4SS for exterior use.

Switches shall be manufactured by G.E., I.T.E., or Westinghouse.

12.17 Motor Disconnect Panels: Motor Disconnect Panels shall be of size and capacity shown on the drawings. Panel shall contain an externally operated motor service switch, designed to circuit breaker specifications, a 600V, 3 phase, Thyrite secondary lightning arrestor connected to load side of switch where installed outdoors, and a 12 point terminal block for control circuits. A red and green pilot light and HOA switch shall be mounted in the cover. Housing shall be NEMA 12 for indoor use and NEMA 4 stainless steel for outdoor or wet locations. All types shall allow for all conduit entries to be either on bottom or top as indicated on the Drawings. Panel shall be by same manufacturer as motor controls.

12.18 Individual Circuit Breakers: Individual circuit breakers shall be molded case thermal-magnetic circuit breaker of frame size and trip rating as shown on the drawings. Breakers shall be provided with an external operating mechanism mounted independent of the breaker. Enclosures shall be NEMA 12 for indoor use and NEMA 4SS for exterior use.

12.19 Wood Backboards: Wood backboards shall be furnished and installed for mounting of equipment and devices to be installed as indicated on the Drawings or as specified below:

> Where two or more cabinets, safety switches, individual circuit breakers, motor starters, time switches, contactors, meters, control devices and transformers are surface mounted at one location, a wood or metal backboard shall be provided for mounting of such equipment. Size of backboard shall be commensurate with number and size of devices and equipment to be mounted thereon.

All wiring on wood backboards shall be made in galvanized wiring troughs and rigid conduit.

Wood backboards shall be 3/4 inch thick, exterior grade "B-C" plywood fastened to wall with 1/4 inch or larger bolts and expansion shields. Backboards shall be painted two coats of gray enamel. Metal backboards shall be as indicated.

Nameplates shall be furnished and affixed by the Contractor on all devices installed in wood backboards. Such nameplates are described elsewhere in this Section.

12.20 Conduits: The conduit installation shall follow the layout shown on the drawings. Where deviations are required due to field conditions, or changes in arrangement of equipment or apparatus, such changes shall be made without additional costs to the Owner.

Rigid galvanized steel conduit shall be used for all systems and locations except as specified for underground raceways or where Electrical Metallic Tubing (EMT) is specified.

Electrical Metallic Tubing may be used only for concealed branch circuits, signal circuits, and control circuits in office areas only.

Minimum size of raceway shall be 3/4".

Conduits shall be sized in accordance with NEC Chapter 9, Table 3C and Table 5, Col. 3.

Exposed raceways shall be run parallel with or at right angles to the building walls. Raceways shall be supported at intervals not exceeding 8 feet and within 3 feet of each outlet box, junction box, cabinet, or fitting.

Individual raceways mounted close to surfaces shall be supported with galvanized two-hole pipe straps, 1/8 inch thick, beam clamps, or electro-galvanized conduit hangers installed on beam clamps. Pendant mounted individual raceways shall be supported with 1/8" steel conduit hangers with removable side bolt.

Where two or more raceways are installed adjacent they shall be installed on electro-galvanized continuous slot channel with electro-galvanized pipe straps. Openings and ends of channels shall be closed with closure strip to prevent

the accumulation of dust.

Suspension rods shall be not less than 3/8" for conduit sizes 2" to 3" and not less than 1/2" for sizes over 3". Where length of rod exceeds 3 feet, a swivel hanger shall be used at the point of attachment to the structure.

All conduit fittings shall be zinc coated, cast ferrous, with threaded conduit entrances. Mogul sizes shall be used for condulets 2-1/2" or larger.

Insulated bushings with separate locknuts, or connectors with insulated throats, shall be installed on all conduits and tubing entering cabinets, outlet boxes and pullboxes.

Insulated grounding bushings shall be used on feeder conduits.

Connectors and couplings for rigid conduit shall be threaded galvanized steel.

Connectors and couplings for electrical metallic tubing shall be compression type, UL approved as concrete and raintight. Bodies and nuts shall be constructed of machined steel zinc plated inside and out. Connectors shall have insulated throats.

Flexible Conduit: Conduits shall be liquid tight flexible steel conduit with internal bonding conductor, with fittings designed to insure ground continuity, for the following applications:

> Connections to motors and motor mounted equipment. (Maximum length 24 inches.)
>
> Connections to transformers.
>
> Connections to solenoid and motorized valves and other small devices subject to vibration, adjustment, equipment disassembly or in working areas when a plug disconnect is used.
>
> Vibration isolated equipment such as air conditioning system.
>
> Connections to recessed lighting fixtures may be standard "Greenfield" with clamp type insulated connectors.

Conduits installed in earth or underground shall be rigid galvanized steel or rigid P.V.C. conduit as shown on the drawings. Rigid conduits shall be encased in reinforced concrete with a minimum separation of 1-1/2" between conduits and a minimum cover of 3" on top, bottom, and sides.

Floor sleeves for electrical and telephone work shall be furnished and installed. They shall be of rigid galvanized steel conduit or galvanized steel pipe, and shall extend 2 inches above finished floor. Where holes are drilled in floor, all space around conduit shall be filled with a waterproof mastic.

Junction boxes or pull boxes shall be installed to avoid excessive runs or bends. Boxes shall be seam welded galvanized sheet steel with code gauge gasketed covers, except where cast ferrous boxes are required. Boxes shall be furnished without knockouts. Boxes used on or near equipment shall be JIC

design. Boxes shall be sized in accordance with NEC 370-18. Depth shall be not less than 2-1/2 times the trade diameter of the conduit.

Offsets in conduits are not indicated and must be furnished where required.

Conduits shall be secured in place and protected to prevent damage to the work during construction. The ends of all conduit runs shall be plugged with plastic stoppers.

All conduits shall be blown out and swabbed clear of water and trash prior to pulling wire.

Where conduits pass through expansion joints in the building, expansion fittings shall be installed. Expansion fittings installed in concrete shall be NEMA 4 Watertight and designed to compensate for both expansion and deflection movements.

Where conduits pass through walls below grade, special sealing sleeves shall be used. Assembly shall consist of an oversize conduit sleeve fitted to a cast body, pressure rings, sealing grommet, and pressure clamp. The cast body and oversized sleeve shall be set in place prior to pouring of concrete. The oversized sleeve shall be filled with sealing compound supplied by the manufacturer of the fitting after the conduit is installed.

Non-metallic rigid conduit shall be used only where indicated on the drawings. Non-metallic shall be Schedule 40 rigid heavy wall P.V.C. conduit U.L. approved for 90°C cable. Conduit shall be encased in concrete as specified for rigid conduit unless noted as direct burial on the drawings. All transitions from underground to above ground shall be in rigid metal conduit.

Non-metallic rigid conduit shall comply with NEMA Pub. TC2 and U.L. Standard U.L. 651.

Rigid conduit shall comply with the requirements of A.N.S.I. Standard C80.1 and U.L. Standard UL6.

Electrical metallic tubing shall comply with the requirements of American National Standard C80.3 and U.L. Standard UL797.

12.21 Terminal Boxes: Terminal boxes shall be installed where shown on the drawings and where splices and taps are required in control conductors. Terminal boxes shall be of NEMA 12 construction and provided with terminal blocks with terminals for each conductor in the enclosure. All terminals shall be numbered and each conductor shall be identified.

12.22 Outlet Boxes: An outlet box shall be provided for each lighting fixture, device, outlet, telephone outlet, signal outlet or junction box indicated on the drawing.

Outlet boxes used in conjunction with enclosed and gasketed fixtures shall be GUA or SEH Series condulets. Outlet boxes for conduit suspended fixtures in dry locations shall be ALC Series condulets with ball aligners. Outlet boxes for chain suspended fixtures with 3 wire cord and plug shall be FSD Series condulets with duplex receptacle.

Outlet boxes recessed in walls and ceilings or located in ceiling spaces shall be made of galvanized steel of #14 gauge thickness. Boxes shall be of form and dimension as to be adapted to its specific use and location, device or fixture to be mounted in or on box, and number, size and arrangement of conduits connecting thereto.

Outlet boxes suface mounted on walls or columns shall be of cast ferrous construction.

Outlet boxes in ceilings, in plastered and gypsum stud walls, and in poured columns and walls, shall be two inches deep, four inches octagonal, four inches square, or 4-11/16 inches square boxes. Plaster covers 1/2 inch in height shall be installed on boxes in unfinished concrete ceilings and in acoustical tile ceilings. Boxes in concrete slab ceilings shall be concrete type.

Outlet boxes recessed in unplastered concrete block walls and partitions shall be designed for installation in block and tile walls and partitions.

Single gang or multi-gang square cornered masonry boxes shall be used for one or more devices at the termination of a conduit run.

Conventional four inch square or 4-11/16 inch square boxes fitted with square tile covers of proper depth for concrete block shall be used where two or more conduit runs enter a box.

Junction boxes shall be provided with blank covers. Covers on ceiling outlets shall be round, and shall be painted to match ceilings. Covers on wall junction box outlets shall be of size and finish as used on switch and receptacle outlets.

Wall and column telephone outlets shall be four inches square, two inches deep, with one-half inch high single device plaster cover. Each such outlet shall be provided with a bushed-hole cover plate of finish specified for wall switches. In unplastered block walls, paragraph above applies.

Floor outlets used in slabs shall be watertight, cast iron floor boxes with fully adjustable tops. Trim and floor plate assemblies shall be polished aluminum.

Steel outlet boxes shall be manufactured by Appleton, Raco, or Steel City.

Condulet outlets shall be manufactured by Appleton, Crouse-Hinds, or Pyle National.

12.23 Location of Outlets: The approximate locations of outlets are shown on the drawings. The exact locations shall be determined at the building. The right is reserved to change the exact location of any switch, ceiling or other outlet in any room before it is permanently installed without additional cost to the Owner.

Mounting heights of outlets shall be at the following heights above the floor, measured to centerline of outlet, unless otherwise noted at symbol:

Wall switch	-48 inches
Convenience outlet	(-12 inches - in Offices (-36 inches - in Plant Buildings.
Thermostats	-66 inches
Pushbutton Stations	-60 inches
Fan switches	-60 inches

Mounting heights of outlets in unplastered concrete block walls shall minimize cutting and patching of masonry. Convenience outlets with a nominal 12 inch mounting height shall be mounted on top of second block course, or 15-5/8 inches from floor to underside of box. Wall switch outlets at nominal 48 inch mounting height shall be mounted on top of the sixth block course, or 47-5/8 inches from floor to underside of box.

Where outlets at different levels are shown adjacent, they shall be installed in one vertical line.

12.24 Wiring: Complete sytems of wiring shall be installed as shown on the Drawings or as specified. Each raceway indicated by symbol on Drawings shall contain two No. 12 AWG wires unless otherwise noted, scheduled or indicated. Hatch marks on raceway symbols indicate the number of No. 12 AWG conductors in a raceway when the number exceeds two.

Conductors for all lighting and 120/208V branch circuits shall be 600V, NEC, Type THW, 75°C wet or dry locations, solid copper conductors, manufactured in accordance with IPCEA Pub. S-61-402.

Conductors for all power feeder, and motor circuits shall be copper and shall have 600V insulation manufactured in accordance with IPCEA Pub. No. S-66-524 and NEMA Pub. WC7-1971 Rev. June, 1976. Insulation shall be rated 90° for dry locations and 75° for wet locations. Minimum insulation shall be: .047" for sizes up to No. 8, .062" for sizes Nos. 8 to 1, .078" for sizes Nos. 1 to 250 MCM, .094 for sizes larger than 250 MCM.

Individual conductors for control circuits shall be NEC Type MTW, 600V, 90 degrees C.

Minimum size of conductors for all systems other than Control and Signaling Systems shall be No. 12 AWG. Sizes Nos. 8 and larger shall be stranded.

Conductors for low voltage remote control for lighting circuits shall be as specified under "LOW VOLTAGE REMOTE CONTROL".

Control conductors shall be identified at every termination. The color-coding in multiple conductor cables constitutes the required identification. Individual conductors shall have a permanent numbered identification tag. All control conductors shall terminate on the device terminals or terminal blocks. Splices or taps in control conductors are not acceptable.

Multiple conductor control cables shall be suitable for installation in conduits below ground and for aerial installation on Messenger cables. Cable shall be rated 600 volts, 90°C. Conductor shall be No. 14 AWG Class B stranded bare copper wire. Insulation over individual conductors shall be a minimum of 30 mils cross linked polyethylene. Conductors shall be bound together with a binder tape and have an outer PVC or neoprene jacket of 60 mils thickness for 16 conductors and below and 80 mils thickness for 17 conductors and above.

Individual conductors shall be color coded in accordance with IPCEA Standard S-61-402, Method 1.

Multiconductor cables shall not be spliced except at approved terminal boxes provided with terminal blocks and terminal schedules and only at approved locations. Conduit will be sized per NEC rules only after cable has been approved and actual cable O.D. has been determined. Conduit sizes given on the plans are based upon specified cable O.D. Extra costs for larger conduit size required by other cables will be borne by the Contractor.

Splices, taps, and terminations shall be made as follows:

> All lugs, connectors, and terminators for wire sizes # 6 AWG and above shall be U.L. approved for copper conductors only.
>
> Lugs for wire sizes No. 6 AWG and larger, when used in conjunction with panelboards, molded case breakers, or disconnect switches, shall be a mechanical type connector. Lugs shall contain a saddle to exert pressure on the conductor by the set screw or bolt. Wire size range of lugs shall not exceed three AWG sizes.
>
> Lugs for wire sizes No. 6 AWG and larger, except as hereinbefore specified, and all in-line and "T" splices, shall be the compression indentor type.
>
> Wire Sizes No. 8 and smaller with insulated steel spring wire connectors.
>
> Terminators for control conductors shall be self-insulated locking spade terminals.
>
> Joints shall be covered with 7 mil vinyl plastic electrical tape on branch circuit wiring connections, and 10 mil vinyl plastic electrical tape on mechancial and indent connectors on larger cables.

At each fixture outlet a loop or end of wire not less than eight inches long shall be left for connection to fixtures.

The continuity of an identified grounded conductor shall not be dependent upon device connections, such as lamp-holders or receptacles, where the removal of such devices would interrupt the continuity.

Branch circuit designations shown on the drawings shall be connected to the same circuit number in the panelboard.

All wire shall be color coded to indicate the various phases and neutral. Where color coding is impractical, 3/4" wide tape bands, corresponding to Color Code, NEC Section 210-5, and as specified below shall be provided.

Color coding for the various systems shall be as follows:

For 120/208 Volt System	For 277/480 Volt System
Phase A - Black	Phase A - Brown
Phase B - Red	Phase B - Orange
Phase C - Blue	Phase C - Yellow
Neutral - White	Neutral - White
Ground - Green	Ground - Green

All 600 volt wire and cable shall be of same manufacturer.

Wire and cable shall be manufactured by Anaconda, Collyer, G.E., General Cable, Okonite, or Rome.

12.25 Wiring Devices: Wall switches shall be furnished and installed where shown on the Drawings.

Wall switches shall be specification grade rated 20 amps., 120-277V.

Single pole toggle switches shall be Arrow Hart #1991, G.E. #GE5951-1, Hubbell #1221, Sierra #5721X, or Slater #720BR.

Three way toggle switches shall be Arrow Hart #1993, G.E. #GE5953-1, Hubbell #1223, Sierra #5773x, or Slater #723BR.

Key operated switches shall be of the same capacity and quality as toggle switches, and of same manufacture.

Switch and pilot shall be lighted button type, Arrow Hart #2999-R, G.E. #GE559-8, or Hubbell #1297.

Receptacles for general use in Office areas shall be Intermediate Grade, 15 Amp., 125 volt, NEMA 5-15R, No. 5252.

Receptacles for general use in process areas shall be Specification Grade, 20 Amp., 125 volt, NEMA 5-20R, No. 5362.

Receptacles for 208 volt outlets shall be Specification Grade, 20 Amp., 250 volt, NEMA 6-20R, No. 5462.

Receptacles shall be of same manufacturer as specified for wall switches.

Cover plates for flush wall outlets in finished spaces (switch, receptacle, telephone, signal) shall be satin finish stainless steel, Grade 302 (18% chrome, 8% nickel), specification grade as manufactured by Arrow-Hart, Hubbell, Slater or Sierra.

12.26 Lighting Fixtures: Lighting fixtures shall be as scheduled on the drawings. Methods of installation, mounting heights, and special instructions are indicated on the drawings.

All pendant mounted fixtures shall have rigid stem pendants connected to swivel aligners at the point of support to the structure and to the conduit system.

Surface mounted fixtures with sheet metal housings shall be provided with 1-1/2" spacers provided by the fixture manufacturer to provide air space between the fixture and the structure.

All lighting fixtures shall be U.L. labeled and U.L. approved for its application.

12.27 Lamps: Lamps shall be furnished and installed in all lighting fixtures. Lamps shall be of type, size, wattage, and color as scheduled on the drawings.

Incandescent lamps shall be rated for 130 volt operation except where other voltages are indicated by catalog number. Lamps designed for rough service will be designed by the suffix "RS" to the ANSI number. Lamps designed for extra long life (2500 hrs.) will be designated by the suffix "XL" to the ANSI number.

Mercury vapor and HID lamps shall be deluxe color corrected.

Lamps shall be manufactured by G.E., Sylvania, or Westinghouse.

12.28 Ballasts: Fluorescent lighting fixtures ballasts shall be high power factor, ETL and CBM approved, Class P. Unless otherwise specified or scheduled, all 48 inch lamps shall be rapid start, and all 96 inch lamps shall be high-output.

Fluorescent lamp ballasts shall be thermally protected against over-heating by a built-in overheat protector sensitive to both winding temperatures and current. Ballasts shall not exceed 90° operating temperature in a 56°C heat box. Tests shall be conducted at a minimum of 15°C. over CBM and U/L testing procedures. Ballasts shall be guaranteed not to overheat capacitor insulating oil beyond manufacturer's warranty limits.

Fluorescent lighting ballasts shall be Advance "Kool Koil", General Electric "Bonus Line" or Universal "VLH".

Ballasts for mercury vapor and metallic additive discharge lamps shall be HPF, UL approved, constant wattage or regulator type. Reactor type and "normal power factor" ballasts shall not be furnished. Ballasts mounted remote from luminaires shall have outdoor cases, and those within fixtures shall be in a weathertight compartment. Ballasts shall be designed for applied voltage.

12.29 Pad Mounted Transformer: The transformer shall be a 3 phase pad mounted liquid filled transformer. Transformer shall be rated 100KVA, 65°C. rise, O.A., nominal 2.0% impedence. Primary shall be 2400 volts, 3 phase, 60 Hz, Delta, 60 B.I.L.. Secondary shall be 208/120 volts, 3 phase, 60 Hz, grounded Wye. Insulated neutral shall be extended through the tank wall and be provided with an external grounding strap. Transformer shall have two 5% FCBN and two 5% FCAN taps operated by a de-energized tap changer with external operating handle.

The primary compartment shall contain an insulated fused disconnect switch with current limiting fuses. Fuses shall be coordinated with the transformer to prevent overloading and to provide fault protection.

The secondary compartment shall contain connection studs, a 600 volt, 3 phase secondary surge arrestor, and three ambient compensated molded case circuit breakers of frame size and trip size indicated on the drawings.

The transformer shall be provided with a weather-proof, tamper-proof metal housing enclosing the High Voltage and Low Voltage terminals and appurtenances. The H.V. and the L.V. Sections shall be separated by a steel barrier. Each section shall have hinged removable doors, removable steel floor plates for rodent protection, and a common tamper proof door locking mechanism with padlocking provisions.

In addition to normal standard service and safety features, the transformers shall have the following accessories:

Hot stick for operating primary fused switch.

Mastic Undercoating.

Oil temperaure gauge.

Oil level gauge.

The transformer shall consist of 3 core and coil assemblies connected together by a common core yoke. Scott or 'T' connections are not acceptable.

Transformer shall be manufactured by G.E., Hevi-Duty, RTE Corp, Uptegraff, or Westinghouse.

12.30 5000V. Conductors: Conductors shall be single conductor, of size indicated, soft drawn copper of 98% conductivity, Class B concentric standing, with a semi-conductive shielding applied over the bare conductor. Insulation shall be Cross-linked-thermosetting-polyethylene rated at 5000V. Insulation shall be in accordance with IPCEA Pub. No. S-66-524, Nema, Pub. No. WC7-1971. A semi-conducting tape and a copper shielding media shall be applied over the insulation. A PVC outer jacket shall be installed over the shielding conductors.

Individual cables shall be terminated with built-up stress cones. The copper conductors shall terminate in a long shank compression lug. Outdoor stress cones shall be weather proofed with 3M Scotch 70 silicone rubber tape. The tape shall completely cover the stress cone and the lug shank. The grounding shield shall be grounded at both ends.

All cables shall be factory tested in accordance with all applicable tests of I.P.C.E.A. Standards. These tests shall include high voltage dielectric tests, both A-C and D-C, conductor resistance measurements, insulation resistance and corona level. Certified test reports shall be supplied to the engineer before the cable is installed.

After the cable has been installed, spliced and terminated, a D.C. test at 80% of factory test voltage shall be applied with all equipment disconnected. Test voltage shall be applied between phase conductor and grounded metal shielding for a period of 10 minutes. D.C. Micro-ampere readings shall be taken at 1 minute intervals during the test, and when plotted shall show a steady decrease in current.

The 5000V cable shall be manufactured by Anaconda, General Cable, G.E., Okonite, or Phelps-Dodge.

12.31 Overhead Line Construction: Hardware shall be hot-dipped galvanized, made to E.E.I. specifications. Messenger cable shall be 3/8" dia., class 'A', zinc-coated-extra galvanized as per ASTM 475-62T, 10M, Siemens-Martin. Messenger cable shall be dead-ended with thimble-eye bolts and feed-thru dead end clamps or preformed grips. Anchors shall be 8" expanding cone type, buried to a depth of 6 ft. Anchor rods shall be 3/4" x 7' thimble-eye.

Fused cutouts shall be load break, open drop-out type, 7.8KV, 100 Amp, 75 BIL with a minimum interrupting capacity of 16,000 Amps.

Lightning arrestors shall be distribution class, valve type, rated at 3,000 volts.

Brackets for mounting of fuse cutouts and lightning arrestors shall be Joslyn #G-27089, Oliver X1667 or McGraw Edison #DC59B2. Steel crossarms shall be Joslyn #SK-83, Oliver #X1548 or McGraw Edison #DC99-B1.

Wood poles shall be creosoted southern pine of length and class as indicated. Poles shall be straight, and be free of bows, knots, and knot-holes. Poles shall be roofed and drilled. Poles shall be full length pressure treated with a preservative in accord with American Wood Preservers Association Standard Specification C4. Poles shall be set to a depth of not less than 5 feet 6 inches. End poles shall be raked 12 inches; in-line poles shall be perpendicular. Poles shall be tamped to 95% compaction.

12.32 Service Switchboard: The service switchboard for the Pre-Chemical Building shall be a free standing, metal-clad, front connected, factory assembled, switchboard. The assembly shall be of NEMA-1A, gasketed, construction, nominal 90" high, 20" deep, with width as indicated, and consist of sections bolted together. Service conduits will enter from the top and branch and feeder conduits will enter from both top and bottom. Finish shall be the manufacturer's standard finish subject to the approval of the engineer.

The main, feeder, and branch circuit breakers shall be panel mounted and arranged as indicated. Breakers shall be removable from the front and all line, load, and bus connections shall be front accessible. Formed, hinged doors shall be provided for the front of each section or vertical gutters. A separate cubicle with hinged door shall be provided for the lighting contactor.

Engraved nameplates shall be provided adjacent to each multi-pole breaker. A typewritten directory card shall be provided for single pole breakers. The directory card shall be installed in a dust-tight, transparent, enclosure.

A voltmeter and selector switch shall be provided as indicated. Voltmeter shall be 4-1/2" of the flush indicating switchboard type, 250° scale, calibrated, 1% accuracy, single phase with a full scale reading of 0-300 V. Selector switch shall give both phase-to-phase and phase-to-neutral readings, and have an OFF position.

Bus shall be silver plated copper of capacity and bracing as indicated. Busing between sections shall be insulated copper conductors with lugs U.L.

approved for copper only. Neutral bus shall be provided for each section. A 1/4" x 2" ground bus shall extend the full width of the assembly. A bus connection, with a removable link, shall connect the neutral and ground buses.

The lighting contactor shall be electrically operated, mechanically held, 3 pole, 30 amp, 250V., ASCO Bulletin No. 920. Pushbuttons and pilot lights shall be oil-tight. Pilot lights shall be of the transformer type.

The service switchboard shall comply with NEMA Pub. PB-2-1972, Rev. 1975 and U.L. 891 Rev. Aug. 1976. Breakers shall comply with U.L. 489, Rev. May 1976.

Approved manufacturers are Arrow-Hart, General Electric, or I.T.E.

12.33 Temporary Wiring: Contractor shall provide temporary wiring to maintain continuity of service to all equipment except where temporary power or light will not be required during outage times specified.

12.34 Payment: No separate payment shall be made for work under this Section of the Specifications.

SECTION NO. 13

PAINTING AND WATERPROOFING

13.01 Materials shall be delivered in unbroken original containers bearing the manufacturer's name, trade name, mixing instructions, and application instructions. Paint manufacturers shall be Koppers Co., Indurall Coatings, Inc., or Industrial Paint Co.

13.02 Painting: Paint shall be applied neither on damp and frosty surfaces, nor during wet, foggy, and freezing weather. Surfaces to be painted shall be made free of dust and other foreign matter before paint is applied; surfaces shall be completely dry before paint is applied. Iron and steel, which has been shop primed, shall have all abrasions in the priming coat cleaned to bright metal to remove all scale, ridges, rust, and faults in the prime coat. Weld splatter shall be removed and that area reprimed. Voids, and open and hollow places, shall be repaired with a material compatible with the surface to be repaired. Paint shall be spread and brushed out so that there shall be no drops, runs, and sags in the coating. Where runs, sags, and drops do occur, they shall be removed and the surface shall be re-coated. Paint shall be dry before additional coats are applied. Drop cloths shall be used to protect surfaces of the structure and equipment in place and, upon completion of work, paint spots shall be removed from surfaces and defaced surfaces shall be re-finished. Painting found to be defective, and that applied under adverse conditions, shall be removed and new paint shall be applied. Where more than one coat is required, undercoats shall be job-tinted.

13.03 Surfaces to be Painted: Surfaces to be painted in this contract consist of the following:

(a) Building Interiors: Paint all structural steel, miscellaneous iron and steel and piping of all sizes and types. All steel handrails, doors, windows, equipment, conduit and exposed electrical work shall be painted. Building walls and ceilings shall be painted as described in the following table:

Building	Surfaces to be Painted
Settling Basin Floculator Gallery	Ceiling and Walls
Chlorine Room Addition	Ceiling and Walls
Filter Gallery	Walls and Ceiling and Underside of Walkway
Filter Super Structure	Ceiling and Walls
Post Chemical Building Basement	Walls and Ceiling
Post Chemical Building Super Sturcture	Ceiling and Walls
Pre Chemical Building (Exist)	Walls and Ceiling Lime Feed and Chlorinater area

Building	Surfaces to be Painted
Modifications to Existing Filters	Ceiling and Walls
Main Building	Ceiling and Walls (1) Control Room and Office (2) Control Room (3) Office (4) Hall
Filters	Walls (coated)

(b) Building Exteriors: Paint all structural steel, miscellaneous iron and steel and exposed piping. All steel handrails, doors, windows, equipment, conduit and exposed electrical work. Submerged ferrous metal shall be coated.

Surfaces to be painted or coated shall be prepared as follows:

(1) Non-submerged ferrous metal surfaces of small miscellaneous items including, but not limited to, handrails, metal doors, cast iron piping, pumps, and pump motors, shall be prepared in accord with SSPC-SP-2, Dated 1970.

(2) Submerged ferrous metal surfaces shall be prepared in accord with SSPC-SP-10, Dated 1970.

(3) All concrete and masonry surfaces to be painted shall be free of dust, form oils, curing compounds, and foreign matter which would interfere with the bond of the coating to the surfaces.

13.04 Structural Steel and Miscellaneous Iron and Steel, before leaving the shop of the fabricator and before being exposed to weather, shall be cleaned of all foreign matter, loose black scale, and rust, and shall receive a priming coat, as listed in Painting Schedule, applied in the shop at the rate of 250 square feet per gallon, and allowed to dry 48 hours. If the prime coat is damaged whether during transit or construction, or has deteriorated due to long exposure to the elements, the metal shall be cleaned and touched-up or reprimed. Valves, gates, and appurtenances thereto, if not tar dipped, shall be primed and painted as specified for miscellaneous iron and steel.

(a) All interior miscellaneous iron and steel shall be painted with two (2) finish coats, as listed in Painting Schedule, after installation. Each coat shall be applied at the rate of 400 square feet per gallon, allowed 24 hours to dry.

(b) All exterior miscellaneous iron and steel shall be painted with two (2) finish coats, as listed in the Painting Schedule, after inatallation; each coat shall be applied at the rate of 400 square feet per gallon, and allowed 24 hours to dry.

(c) All miscellaneous iron and steel to be installed in pits, vaults, galleries, and in locations where those items will be exposed to extreme humidity and condensation, shall be painted with three (3) finish coats, as listed in the Painting Schedule, after installation. Each coat shall

be applied at the rate of 250 square feet per gallon, and allowed 24 hours to dry.

(d) All structural steel and steel joists shall be painted with two (2) finish coats, as listed in the Painting Schedule, after erection. Each coat shall be applied at the rate of 250 square feet per gallon, and allowed 24 hours to dry.

(e) All miscellaneous iron and steel to be installed in locations which will normally be covered with water shall be painted with three (3) finish coats, as listed in the Painting Schedule, after installation. Each coat shall be applied at the rate of 150 square feet per gallon, and allowed 48 hours to dry.

13.05 Galvanized Iron shall be cleaned and treated with a metal conditioner and, within 24 hours after that treatment, a priming coat, as listed in the Painting Schedule, shall be applied at the rate of 250 square feet per gallon, and allowed 48 hours to dry. After erection, galvanized iron shall be painted with two (2) finish coats, as listed in the Painting Schedule, each coat shall be applied at the rate of 250 square feet per gallon, and allowed 24 hours to dry.

13.06 Exposed Cast Iron Piping Systems, including fittings, valves, and tar-dipped gates and appurtenances, shall be cleaned of all loose paint, dirt, oil, grease, rust, scale, and other foreign materials after installation, and be coated with two (2) prime coats; each coat shall be applied at the rate of 200 square feet per gallon. Paint shall be applied with care to insure that all areas are completely covered by both coats. A drying time of 24 hours shall be observed between the first and second coats, and a drying time of 48 hours shall be observed between the second coat and the first finish coat. The finish shall consist of two (2) coats, as listed in the Painting Schedule, each coat shall be applied at the rate of 250 square feet per gallon, and allowed 24 hours to dry. Cast iron pipe is required to be furnished with prime coat. Two additional field prime coats are required.

13.07 Exposed Electrical Work, including conduit, condulets, and cabinets, shall be cleaned and treated, then given one (1) coat of primer, as listed in the Painting Schedule. Finish painting shall consist of two (2) coats, as listed in the Painting Schedule, each coat shall be applied at the rate of 250 square feet per gallon, and allowed 24 hours to dry. Color of finish coat shall be the same as that of the surfaces upon which the conduit is mounted.

13.08 Copper Piping: All copper shall be thoroughly clean after installation and given one coat of Clear Vinyl.

13.09 Interior Concrete shall be painted as follows:

(a) Concrete columns shall be finished in accord with the CONCRETE WORK section, and shall be cleaned of dust, curing compound, and other foreign matter prior to painting. After cleaning, surfaces to be painted shall be painted with two (2) prime coats and one (1) finish coat, as listed in the Painting Schedule. Dado shall be 4'-0" high.

(b) Concrete and Brick Unit Masonry Walls shall be pointed, and shall be cleaned of all adhering mortar, dust, oil, and foreign matter prior to painting. After cleaning, the surfaces to be painted shall be painted

with two (2) prime coats and one (1) finish coat, as listed in the Painting Schedule. Dado shall be 4'-0" high.

13.10 Exposed Concrete Ceilings shall be clean, dry, and bubble holes and other imperfections in surfaces shall be filled and smoothed prior to painting. Ceilings shall be painted with two (2) prime coats, each coat shall be applied at the rate of 200 square feet per gallon, and allowed 24 hours to dry. Finish shall consist of one (1) coat, as listed in the Painting Schedule, applied at the rate of 250 square feet per gallon, and allowed 24 hours to dry.

13.11 Ferrous Metal Doors and Door Frames shall receive a priming coat applied in the shop. After doors and door frames have been installed, and hardware has been applied, door and frame surfaces shall be cleaned. Surfaces within the building shall be painted with two (2) finish coats, each coat shall be applied at the rate of 250 square feet per gallon, and allowed 24 hours to dry. Surfaces outside the building shall be painted with two (2) finish coats, as listed in the Painting Schedule, each coat shall be applied at the rate of 400 square feet per gallon, and allowed 24 hours to dry.

13.12 Equipment shall be cleaned, and shall be painted with three (3) finish coats, as listed in the Painting Schedule, each coat shall be applied at the rate of 250 square feet per gallon, and allowed 24 hours to dry. Leave all name plates and non-ferrous metal trim unpainted.

13.13 Waterproofing: Waterproofer shall be applied to all outside surfaces of dry pit concrete walls which may come into contact with earth. Waterproofer shall extend from, and include, the tops of footings to lines laid-off accurately 6" below grade. Apply in 2 coats at 50-60 sq. ft./gallon to give a dry film thickness of 12-15 mils per coat. Allow 12-24 hours between coats. Application shall be made only in dry weather and only when atmospheric temperature is warmer than 40° F.

13.14 Filters and Post Flash Mixer Coating: Wash and scrub concrete surfaces, flush and etch with acid, flush and scrub with ammonia, apply one coat of Koppers Ramuc Undercoater Type A and pre-coat of Koppers Ramuc Enamel Type A, or equal products of Indurall or Industrial Paint Co. Filter walls shall be painted prior to installation of filter bottoms, and repainted where damaged when filter bottoms are complete. The Post Mixing chamber shall be painted after equipment installation. Undercoater shall be applied at the rate of 200 square feet per gallon and enamel at the rate of 250 square feet per gallon.

13.15 Settling Basin Coating: Surface preparation shall be as specified for filter and post flash mixer coatings and two coats of Inertol 49 thick or equivalent Indurall Coatings, Inc., or Industrial Paint Co. applied at the rate of 115 square feet per gallon. The areas of the floculation and sedimentation basin adjacent to the floculater dry pit shall be painted. This area consists of one wall of each floculater chamber and the sedimentation tank wall which is common with the drainage pit on the influent end.

13.16 Payment: No separate payment will be made for work under this Specification, except as may be specifically set forth in the Proposal. The cost of such work and all cost incidental thereto, except such work as may be specifically set forth in the Proposal, shall be included in the price bid for the item to which the work pertains.

PAINTING SCHEDULE

SURFACES	APPLICATION	MANUFACTURER		
		KOPPERS CO.	INDURALL COATINGS, INC.	INDUSTRIAL PAINT CO.
1. Structural Steel and Miscellaneous Iron and Steel	Shop Primer One (1) coat	Rust-Inhibitive Primer No. 622	H-1175 Primer	Phenolic Primer M-6580
(a) All interior miscellaneous iron and steel	Finish Two (2) coats	Glamortex 501 Enamel Eye Rest Green 369-Gloss	A-5108 Enamel	Alkyd M-5842 Light Green
(b) All exterior miscellaneous iron and steel	Finish Two (2) coats	Glamortex 501 Enamel Jade Green 336-Gloss	Indurlux A-5555	Alkyd M-5824 Shamrock Green
(c) All miscellaneous iron and steel in vaults, pits, galleries, and in areas exposed to extreme humidity and condensation.	Finish Three (3) coats	Ramuc Utility Enamel Jade Green 336-Gloss	Rust Inhibitive Metal Finish A-5555	Rubber Base M-6424 Shamrock Green
(d) All structural steel and steel joist	Finish Two (2) coats	Ramuc Utility Enamel Mista Green 365-Gloss	Rust Inhibitive Metal Finish A-5735	Rubber Base M-6422 Aqua Mist
(e) All miscellaneous iron and steel in areas covered with water	Finish Three (3) coats	Inertol No. 49 Thick	Utility Products Waterworks Mastic (4 hours drying time)	
2. Galvanized Iron	Treatment Primer One (1) coat Finish Two (2) coats	30 Metal Conditioner Rust Inhibitive Primer No. 622 Ramuc Utility Enamel Eye Rest Green 369-Gloss	H4-1109 Conditioner G-1221 Primer Rust Inhibitive Metal Finish A-5555	M-7947 Metal Conditioner Red Lead Phenolic Primer M-6580 Rubber Base M-6442 Light Green
3. Exposed Cast Iron Piping System (primed in shop)	Field Primer Two (2) coats Finish Two (2) coats	Rust-Inhibitive Primer No. 622 Ramuc Utility Enamel Eye Rest Green 369-Gloss	H-1175 Primer Rust Inhibitive Metal Seal A-5108	Phenolic Primer M-6580 Norcoro Rubber Base M-6442 Light Green

PAINTING SCHEDULE

SURFACES	APPLICATION	MANUFACTURER		
		KOPPERS CO.	INDURALL COATINGS, INC.	INDUSTRIAL PAINT CO.
4. Exposed Electrical Work	Treatment	40 Passivator	H4-1109 Conditioner	Norcoro M-7947 Metal Conditioner.
	Field Primer One (1) coat	Rust Inhibitive Primer 622	G-1221 Primer	Norcoro Red Lead Phenolic Primer M-6580
	Finish Two (2) coats	Ramuc Utility Enamel	Rust Inhibitive Enamel Finish A-5555	Norcoro Rubber Base M-6400 Light Green
5. Interior Concrete and Concrete Unit Masonry (a) Concrete Columns	Primer Two (2) coats	Ramuc Utility Undercoater	Indurall P-1120	Norcoro M-7563 Concrete and Cement Seal Primer
	Finish One (1) coat	Ramuc Utility Enamel Dado-Eye Rest Green 369-Gloss Surface above Dado - Vista Green 365 Gloss	Indurall Perma-Clean Dado C4-5347 Surface above Dado C4-5346	Norcoro M-7901 Rubber Glaze Semi-Gloss Dado - No. 42 Light Green Surface above Dado - No. 22 Aqua Mist
(b) Concrete Unit Masonry Walls	Primer Two (2) coats	Ramuc Utility Undercoater	Indurall P-1120	Norcoro M-7563 Concrete and Cement Seal Primer.
	Finish One (1) coat	Ramuc Utility Enamel Dado - Eye Rest Green 369 Gloss Surface above Dado - Vista Green 365 Gloss	Indurall Perma-Clean Dado C4-5347 Surface above Dado C4-5346	Norcoro M-7901 Rubber Glaze Semi-Gloss, Dado - No. 42 Light Green. Surface above Dado - No. 22 Aqua Mist.
6. Exposed Concrete Ceilings	Primer Two (2) coats	Ramuc Utility Undercoater	Indurall P-1120	Norcoro M-7563 Concrete and Cement Seal Primer.
	Finish One (1) coat	Ramuc Utility Enamel Vista Green 365 Gloss	Indurall Perma-Clean C4-5346	Norcoro M-7901 Rubber Glaze Semi-Gloss No. 22 Aqua Mist.
7. Ferrous Metal Doors and Door Frames	Shop Primer One (1) coat	Rust-Inhibitive Primer No. 622	G-1221 Primer	Norcoro Red Lead Phenolic. Primer M-6580
	Finish (Interior) Two (2) coats	Ramuc Utility Enamel Glamortex 501 Enamel Eye Rest Green	Indurlux Enamel A-5108 Rust Inhibitive Metal	Norcoro Rubber Base M-6442 Light Green.

PAINTING SCHEDULE

	SURFACES	APPLICATION	MANUFACTURER KOPPERS CO.	 INDURALL COATINGS, INC.	 INDUSTRIAL PAINT CO.
7.	(Continued)	Finish (Exterior) Two (2) coats	369-Gloss (Interior and Exterior)	Finish A-5735	Norcoro Rubber Base M-6442 Light Green
8.	Equipment	Finish Three (3) coats	Ramuc Utility Enamel Eye Rest Green 369-Gloss	Rust Inhibitive Metal Finish A-5735	Norcoro Alkyd M-5842 Light Green
9.	Waterproofing	Finish Two (2) coats	Bituplastic No. 28	Utility Products Thick & Quick Mastic	Norcoro Hi-Build Catalyzed Epoxy Primer M-7889
10.	Lime Storage Hoppers				
	(Exterior Surface)	Shop Primer One (1) coat 1.5 mils	Inertol Rust-Inhibitive Primer 621	Industrial Primer G-1081	Primer M-6511
		Field Primer One (1) coat 1.5 mils	Koppers 622 Rust-Penetrating Primer	Industrial Primer G-1081	Primer M-6511
		Finish Two (2) coats 1.5 mils each coat	Inertol 5510 Aluminum	"Aluminum Paint"	"Aluminum Paint"
				VINYL SYSTEM	
	(Interior Surface)	Shop Primer One (1) coat 1.5 mils	Inertol Rust-Inhibitive Primer 621	Primer A-8527	Primer M-4980
		Field Primer One (1) coat 1.5 mils	Inertol Quick Drying Primer 626	Primer A-8527	Primer M-4980
		Finish Three (3) coats	Inertol No. 49 Thick, each coat 5.0 mils	One (1) coat A-1313 One (1) coat A-8527 One (1) coat J-1137 1.5 mils each coat	One (1) coat M-4981 1.75 mils One (1) coat M-4980 1.50 mils One (1) coat M-4982 1.0 mils

SECTION NO. 14

PIPE LINES AND APPURTENANCES

14.01 Scope: This Specification covers Division One pipe lines and outside pressure piping for Division Two. The Contractor shall furnish all material, except as specified herein, all labor, tools, construction equipment, of whatever nature, necessary to construct and put in complete working order the pipe lines and appurtenances shown on the drawings and specified. The work shall include all clearing, trenching and excavation, pumping, bailing and draining, sheeting, pipe laying, backfilling, flushing, testing and sterilization of lines and all provisions necessary to protect and maintain buildings, fences, water and gas lines, power and telephone lines and cables, drainage and other structures, the furnishing and maintenance of suitable bridges and footways across intercepted streets, alleys and walkways, the replacing of street pavement, the cleaning away of all rubbish and surplus excavated material, and all such other work as may be necessary to complete the project.

Alternate bids will be received for ductile iron and prestressed concrete pipe. For Division One work materials will be selected by the Owner for the unit price bid. For outside pressure piping in Division Two, the outside piping shall begin 24-inches outside building lines or as shown on the drawings. The material selected will be determined as provided in the Proposal.

14.02 Ductile Cast Iron Pipe Thickness: Ductile cast iron pipe minimum thickness required is indicated in the following table. To these thicknesses the manufacturer's foundry tolerance should be added so that no pipe has a wall thickness of less than shown in the table.

Location	Pipe Size	Min. Wall Thickness	Working Pressure	Cover Requiring Special Bedding
Line A Sta. 27+00 to 86+00	20"	0.38	100	9 to 17 feet
	20"	0.38	150	9 to 17 feet
	16"	0.33	100	9 to 17 feet
Line B	36"	0.41	150	5 to 9 feet
	36"	0.51	150	9 to 17 feet
Line C	16"	0.33	150	9 to 17 feet
Line D	16"	0.33	150	9 to 17 feet
Yard Piping	42"	0.58	50	9 to 17 feet
	36"	0.51	150	9 to 17 feet
	30"	0.44	150	9 to 17 feet
	24"	0.41	50	9 to 17 feet
	20"	0.38	50	9 to 17 feet
	16"	0.33	50	9 to 17 feet

Fittings shall be mechanical joint type. Designed for the preceding pressures with a safety factor of 2.5, but with minimum wall thickness previously specified.

All fittings except 90° bends shall be ASA short radius dimension, 90° bends shall be long radius.

Fittings shall be made of 60-42-10 or 80-60-03 ductile cast iron, and shall be cement mortar lined inside and bituminous coated outside as specified for pipe.

Connections 8-inch and smaller may be made using tapping saddles with corrosion resistant straps.

Access manholes where required shall conform to AWWA Steel Pipe Manual M-11, Figure 19.32 with 1/4" steel pipe cover and insulation gaskets.

Restrained joints shall be "Lox-Tyton" or "Lok-Tyte" as manufactured by U. S. Pipe, or "Lok-Fast" as manufactured by ACIPCO.

14.03 Manufacture of Ductile Cast Iron Pipe:

(a) Ductile Cast Iron Pipe: Ductile cast iron pipe shall be centrifugally cast and shall conform to ASA Specification A21-51 Grade 60-42-10 with push-on joints, complete with gaskets. Pipe shall be cement mortar lined and seal coated, in accordance with AWWA Specification C104-74.

(b) Inspection: The manufacture of Ductile cast iron pipe and fittings will be subjected to inspection at the place of manufacture by a representative of the Owner or by an acceptable and responsible testing laboratory selected by the Owner, if the Owner so elects, which inspection shall not, however, relieve the manufacturer of responsibility for inferior or imperfect materials or workmanship or for prevention of any damage between the time of shipment and the time of acceptance by the installation Contractor.

(c) Testing: Each pipe shall be subjected to a hydrostatic test at the pressures given in accordance with paragraph 4.3 of Federal Specification WW-P-421b. The pipe shall be under the test pressure for not less than one-half minute. The test may be made either before or after coating, but shall be made before any lining has been applied.

(d) Exterior Coating: The exterior coating of Ductile cast iron pipe and fittings shall consist of the standard pipe coating cold tar pitch varnish. Such coating may be applied cold and shall thoroughly cover all metal surfaces. The coating shall be smooth, glossy, shall be not brittle when cold and not sticky when exposed to the sun. The coating shall adhere to the metal at all temperatures, and shall not impart taste or odor to the water.

(e) Gray Cast Iron Pipe: Refer to Section No. 7, Para. 7.05.

14.04 Laying and Jointing Ductile Cast Iron Pipe and Fittings: The Contractor shall lay all pipe and fittings to accurately conform to the lines and grades established by the Engineer and as follows:

(a) Handling: Proper and suitable tools and equipment, for the safe and convenient handling and laying of pipe shall be used, and great care shall

be taken to prevent the pipe coating from being damaged, particularly the cement lining on the interior of the pipe. All pipe shall be carefully examined for cracks and other defects, and no pipe or casting shall be laid which is known to be defective. If any pipe or other casting is discovered to be cracked, broken or defective, after being laid, it shall be removed and replaced with sound material, without further charge. All pipe and fittings shall be thoroughly cleaned before being laid, and shall be kept clean until accepted in the completed work.

(b) Alignment and Gradient: Pipe line alignment and gradient shall be straight, or shall follow true curves as near as is practicable. Curvature in pipe lines, where required shall be well within the allowable laying radius, horizontal or vertical.

(c) Sequence of Work: Excavation, cleaning, laying, jointing and backfilling shall be kept up as closely as is possible so as to progress the work in a uniform, workmanlike manner. In no case shall pipe be left in the trench overnight without completing jointing. The completed pipe line shall not be left exposed in the trench unnecessarily and the Contractor will be required to backfill and compact the trench as soon as is possible after laying and jointing is completed. Each day at the close of work, and at all times when laying is not in progress the exposed end of the pipe line in the trench shall be closed by the use of an approved head or barrier of wood or metals. If at any time it becomes necessary to cover the end of an uncompleted pipe line with backfill the end of such pipe line shall be closed using a mechanical joint plug.

(d) Mechanical Jointing: Joints for mechanical joint pipe shall be made only by experienced mechanics. Sockets and spigots shall be washed with soapy water before slipping gland and gasket over spigot. The spigot shall be inserted in the socket full depth. The gasket shall be brushed with soapy water and shall be pushed into position making sure the gasket is evenly seated in the socket. The gland shall be slid into position for compressing gasket. All bolts and nuts shall be tightened "finger-tight", after which bolts shall be tightened to a uniform permanent tightness using a torque wrench for tightening. Bolts shall be tightened alternately 180 degrees apart. Sockets, spigots, glands and bolts shall be kept clean and wet with soapy water until each joint is completed. Any joints which leak shall be remade.

(e) Bell and Spigot Jointing: All bell-spigot connections shall be joined with lead and moulded rubber gaskets as specified herein. The inside of the bell and the outside of the pipe shall be thoroughly cleaned. Only joint runners in good condition shall be used on the work.

(1) Lead and Gaskets: The moulded rubber gaskets shall be kept clean and shall be free from oil and tar. The gaskets shall be cut into lengths as necessary, and shall be tightly driven home in such a manner as to properly center the spigot in the bell. The depth of the lead joint shall be not less than 2 inches and, in all cases, must be poured to the full depth of the lead groove. The melting pot shall be kept near the joint to be poured and not more than one pouring shall be made for each joint. Dross shall not be allowed to accumulate in the melting pot. The joints shall be thoroughly caulked by competent mechanics in such a manner as to secure a tight

joint without overstraining the iron in the bells. All defective joints shall be melted out and replaced to the satisfaction of the Engineer.

(f) Jointing Slip-On Type Joints: Slip-on type joints shall be made in accordance with the recommendations of the manufacturer.

(g) Jointing Flanged Connections: Flanges shall have 125# American Standard drilling. Gaskets of rainbow rubber, or equal, with cloth inserts, shall be used. Flanges shall be firmly bolted with machine bolts of the proper size and thread. The bolts and nuts shall be of the best quality refined bar iron, with good, true threads, and shall be so tightened as to evenly distribute the stress in the bolts and bring the pipe into uniform alignment.

(h) Cutting: Wherever pipe or special castings are required to be cut, the cutting shall be done by skilled workmen using approved pipe cutters. Torches and hammer and chisel will not be permitted.

(i) Certification: The manufacturer of iron pipe and fittings shall furnish both the Engineer and the Owner with certified reports stating that inspection and specified tests have been made and that the results thereof comply with the applicable ASA Specifications for each.

14.05 Concrete Pressure Pipe and Fittings: Prestressed concrete pressure pipe and fittings shall be manufactured in accordance with AWWA Standard C301-72. The pipe shall have the following principal features: a welded steel cylinder with steel joint rings welded to its ends; for lined-cylinder pipe, a core consisting of a lining of concrete within the steel cylinder, or for embedded-cylinder pipe, a core consisting of the steel cylinder encased in concrete; reinforcement consisting of high-tensile wire wound around the outside of the core in one or more layers at a predetermined stress and securely fastened at its ends; a coating of dense mortar or concrete covering the core and wire, except for the necessarily exposed surfaces of the joint rings; a self-centering joint with a preformed gasket of rubber, so designed that the joint will be watertight under all conditions of service. Fittings shall be either Type A - steel cylinder with concrete or mortar lining, and reinforced concrete or mortar exterior coating; or Type B - welded steel plate with mortar coating on interior and exterior surfaces. Design conditions for fittings shall be same as the pipe. Fittings shall be furnished ASA short radius dimensions for 0 to 60° and ASA long radius from 60° to 90°.

All welds shall be made by certified welders and at least 25% tested by an independent testing laboratory using X-ray or ultra-sonic techniques.

(a) Design Pressures and Trench Loadings: Concrete pressure pipe shall be designed for the following combined pressures and trench loadings in accordance with the cubic parabola design procedure. The test pressure in combination with 3-edge bearing loads given in the following table shall be used for design.

Location	Pipe Size	3 Edge Bearing	Working Pressure	Test Pressure	Cover Requiring Special Bedding
Line A	20"	4500	100 psi	150 psi	9 to 17 feet
Sta. 27+00 to 86+00	20"	4500	150 psi	200 psi	9 to 17 feet
	16"	4400	100 psi	150 psi	11 to 20 feet
Line B	36"	4200	150 psi	200 psi	5 to 11 feet
Line C	16"	4400	150 psi	200 psi	11 to 20 feet
Line D	16"	4400	150 psi	200 psi	11 to 20 feet
Yard Piping					
	42"	4600	50 psi	100 psi	5 to 10 feet
	42"	6700	50 psi	100 psi	8 to 17 feet
High Service	36"	4200	150 psi	200 psi	5 to 10 feet
	36"	6700	50 psi	100 psi	8 to 17 feet
High Service	30"	3600	150 psi	200 psi	5 to 10 feet
	30"	5700	50 psi	100 psi	8 to 17 feet
	24"	4500	50 psi	100 psi	9 to 17 feet
	20"	4400	50 psi	100 psi	9 to 17 feet

All pipe shall be designed for an operating pressure in combination with the earth cover as shown on plans. In no case, however, will the design earth load be less than that due to 9 foot of cover with "ordinary" bedding, and shall be designed to withstand a live load equal to AASHO H-20 loading. In addition, the design shall provide for surge pressure of at least 40 per cent of design pressure.

(b) Outlets: Outlets for connections to 6-inch blow-offs, shall be flush flanged outlets faced, drilled and tapped for ASA Specification B16-1, Class 125, flanged connection.

Outlets size 6-inch and larger, other than those for 6" blow-offs, shall have mechanical joint bells.

Outlets size 2-inch and smaller, shall be provided with threads to fit Mueller I.P. thread corporation stops. Small outlets shall be cast steel and located in the pipe bells.

(c) Certification: The manufacturer of pressure concrete pipe and fittings shall furnish both the Engineer and the Owner with certified reports stating that inspection and specified tests have been made and that the results thereof comply with applicable AWWA Specifications.

(d) Joints: Joints shall be of the steel ring, bell and spigot, rubber gasket type. Harnessed joints may be either welded or subsqueous type.

(e) Inspection: The manufacturer of all reinforced concrete pipe and fittings will be subjected to inspection at the place of manufacture by a representative of the Owner or by an acceptable and responsible testing laboratory selected by the Owner, if the Owner so elects, which inspection shall not, however, relieve the manufacturer of responsibility for inferior or imperfect materials or workmanship or for prevention of any damage between the time of shipment and time of acceptance by the installation contractor.

(f) Testing: Steel cylinders with joint rings welded to ends and completed concrete pressure pipe shall be tested in accordance with the following:

(1) Steel Cylinders: Each steel cylinder with joint rings welded to its ends shall be subjected to a hydrostatic test under a water pressure which stresses the 16 gauge steel to a unit stress of between 20,000 and 25,000 psi. While under pressure test all welds in the steel cylinder shall be thoroughly inspected and all parts showing any leakage shall be marked. Cylinders which show any leakage under test shall be rewelded at the points of leakage and subjected to an additional hydrostatic test. The finished steel cylinder with joint rings attached shall not be used in the work unless it is found to be completely watertight under the required test pressure.

(2) Completed Pressure Pipe: The manufacturer shall provide for testing a minimum of two and a maximum of four sections of completed concrete pressure pipe of such design furnished to be selected at random and subjected to test pressure at the place of manufacture by a representative of the Owner. If such tests are satisfactory, no further testing of completed concrete pressure pipe will be required. If such tests prove to be unsatisfactory, additional pipe will be selected at random and tested until there is sufficient evidence to the satisfaction of the Owner that concrete pressure pipe being supplied for installation in the work is satisfactory. One 3 edge bearing test to destruction will be required for each design.

(g) Concrete Pressure Pipe and Fittings, Adaption to Horizontal and Vertical Curvature: The horizontal and vertical curvature of the filtered water supply line will be as shown on the drawings. The Contractor shall adapt pipe and fittings to suit such curvatures and shall furnish placing drawings accordingly, and in accordance with the provisions of the section "Instructions to Bidders and Special Provisions" of these Specifications.

14.06 General Provisions for Laying Pressure Concrete Pipe: Reinforced concrete pipe and fittings shall be laid so as to accurately conform to the lines and grades established by the Engineer.

(a) Handling: Proper and suitable equipment for safe and convenient handling and laying of pipe shall be used and great care shall be taken to prevent damage, particularly to spigots, bells and end shoulders. All pipes and fittings shall be carefully examined for cracks and other defects before laying and no pipe or fitting shall be laid which is known to be defective. If any pipe or fitting is discovered to be cracked,

broken or defective, after being laid, it shall be removed and replaced, without further charge.

(b) Cleaning: The pipe and fittings shall be thoroughly cleaned before being laid and shall be kept clean until accepted in the completed work.

(c) Alignment and Grade: Pipe line alignment and gradients shall be straight or shall follow true curves as near as it is practicable. Any curvature shall be well within the allowable laying radius, horizontal or vertical. A laying square shall be used to insure proper and uniform trench grade.

(d) Bedding: Bedding shall be as specified under the paragraph "General Provisions for Cleaning and Laying Pipe Lines" and the pipe shall be bedded to a true line. No wedging up or blocking up of the pipe in the trench will be allowed. As soon as the pipe is laid, sufficient backfill shall be tamped along the sides of the pipe to protect it from any movement.

(e) Jointing: The pipes and fittings shall be carefully lowered into the trench by crane or other similar means. Prior to joining the pipes, the surfaces of the joint rings shall be wiped clean and the joint rings and rubber gasket shall be liberally lubricated with an approved type of soap manufactured of vegetable oil. Immediately after cleaning the joint rings and lubrication of rings and gasket, the spigot end, with the gasket in the groove, shall be entered into the bell of the pipe first laid. Both pipes shall be carefully aligned after which the pipe to be laid shall be forced "nearly home". Before the pipe is forced "fully home" the position of the joint gasket shall be checked for proper position by means of a suitable feeler gauge. If, by feeler gauge check, any gasket is found to be out of proper position, the pipes shall be pulled apart and the defective gasket replaced. In final acceptable position, the joint between any two pipes or pieces shall not be deflected more than one-half (1/2") inch at any point.

(f) Grouting Joints: Upon completion of joining, a band of cloth, at least 5-1/2 inches wide, shall be drawn around the outside of the pipe joint, to serve as a form for placing cement mortar grout in the external recess of the face of the bell and the shoulder of the spigot. The cloth band shall be wired around the outside of the pipe and the grout poured before backfilling trench. Cloth bands shall be obtained from the pipe and fittings manufacturer to be exactly suitable for the purpose intended. Grout shall be prepared using clean sharp sand and Portland cement mixed in proportion, 2 parts sand, 1 part cement. The external and internal recess shall be grouted full completely around. Grout that has been allowed to develop initial set or grout requiring "retempering" shall not be used.

(g) Sequence of Work: The excavation, pipe laying, jointing and backfilling shall be kept up as closely as possible so that the work may progress in a uniform workmanlike manner. The completed pipe line shall not be left exposed in the trench unnecessarily and the Contractor shall completely backfill the trench as quickly as possible. The ends of completed pipe line, unless otherwise permitted, shall be closed by an approved head or barrier of wood or metal.

(h) Floating: The Contractor shall take every precaution against the floating of the pipe due to water flowing in the trench before the backfill is completed. In case any pipe does float, the Contractor shall replace such pipe in the manner directed by the Engineer, making good at his own expense any injury or damage which may result.

(i) Connections: Connections for air valves, blow-offs and other connections shall be as specified and listed in the Proposal.

14.07 Accessories: Glands, bolts and gaskets, dresser couplings, lubricants, and all other items required to install the pipe line shall be furnished by the pipe supplier. Glands, bolts and gaskets shall be furnished with the valves.

14.08 Standard Gate Valves: The Contractor shall furnish and install all gate valves as indicated on the drawings, listed in the Proposal, and specified herein. Gate valves size 2-inch and larger shall conform, in general, with the latest specifications of the American Water Works Association, Designation C500-71, shall be equipped with "O" ring packing and shall be as follows:

(a) General Construction: Gate valves shall embody the best class of workmanship and finish, and shall open and close freely and easily. In closing the gates shall move to their position opposite the ports, both discs being then closed squarely against the seat rings. With discs raised, each valve shall have a clear water way of the full nominal diameter of the valve. All wearing and bearing faces shall be suitably proportioned, and all working parts shall be of bronze, or bronze mounted. The seats and face rings for the valve discs shall be of satisfactory dimensions, according to the best shop practice, and the seat rings shall be faced in a lathe, to a true and even surface, so to form a watertight joint when drawn together; and if such joint cannot be produced by machine work, then the faces shall be dressed, and with disc ground to its own true bearing without the aid of templates. Such face rings shall be securely screwed into the recesses made therefor in the valve case. The face rings of the discs shall be machined, dovetailed or driven into corresponding machined grooves in the discs of gates and riveted on with suitable non-corrodible metal rivets. Gate valves shall be furnished for vertical installation, N.R.S. with operating nuts. All stems shall be forged bronze.

(b) Working Pressure: Gate valves 12 inches and smaller shall be furnished for 175 p.s.i. water working pressure. Gate valves larger than 12" shall be furnished for 150 p.s.i., water working pressure.

(c) Operation: All valves shall open LEFT. Valves shall be operated by nut. Operating nuts shall conform to present city standard and shall have an arrow cast on them, indicating the direction for opening the valve.

(d) Marking: Each valve shall be plainly marked with the manufacturer's name or particular mark, the year of manufacture, the size of the valve and designation indicating working pressure, all cast on the bonnet or body.

(e) Installation: Gate valves 12 inches and smaller shall be furnished for vertical installation, N.R.S., with operating nut.

(f) Testing: All gate valves shall be tested in accordance with American Water Works Association Standards.

(g) Jointing: All gate valves, unless otherwise indicated on the drawings or necessary to join to existing work, shall be furnished with mechanical joints, and necessary bolts, glands and gaskets.

(h) Valve Boxes: All buried gate valves shall be equipped with valve boxes. Valve boxes shall be heavy roadway type. The valve boxes shall be case iron two piece slide type with drop covers. The word "Water" shall be cast in raised letters on the cover. The valve boxes shall be adjustable to 5" up or down from the nominal cover over the pipe. Extension stems shall be installed inside the valve boxes with operating nuts to within 6" of finished grade.

(i) Manufacture: Valves shall be furnished as manufactured by Mueller Company, A. P. Smith Manufacturing Company, or Darling.

14.09 Butterfly Valves: All butterfly valves for pipe line or outside pressure pipe service shall be of the tight closing rubber seat type and shall be furnished as manufactured by Henry Pratt, Darling, Allis-Chalmers, or approved equal. All valves shall comply with AWWA Specification C504-74. All valves 36-inch and larger shall be butterfly valves unless shown or specified otherwise and shall meet the following requirements:

(a) Class: Yard piping valves for low pressure service shall be Class 25, designed for 16 fps velocity. High pressure valves shall be Class 150 designed for 16 fps velocity.

(b) Valve Construction: Valve construction shall be as follows:

(1) Valve Body: Valve bodies shall be of cast iron, ASTM A126, Class B, or ASTM A48, Class 40 with mechanical joint or prestressed pipe ends.

(2) Valve Shafts: Valve shafts shall be 18-8, Type 304 stainless steel.

(3) Valve Discs: Valve discs shall be cast iron ASTM, A126, Class B, or ASTM A48, Class 40 with 18-8 Type 316 stainless steel seating edges or ASTM A436 Type 1, Stainless cast-iron. If the rubber seat is on the disc then the body seat shall be 18-8, Type 316 stainless steel.

(4) Valve Seats: Valve seats shall be of hycar or natural rubber. Performance tests required in Section 12 of AWWA Specification C504-74 which refer to performance and leakage tests shall be preformed and certified by the manufacturers.

(c) Valve Operators: Valve operators shall be totally enclosed worm gears suitable for buried service or with extended bonnet suitable for outdoor service as shown on the plans and in accordance with AWWA C504-74.

14.10 Hydrants: Fire hydrants shall be 4-1/4-inch AWWA dry barrel type, 3-way traffic model hydrants, of dry top construction with O-ring seal and shall be equipped with 6-inch mechanical joint connection and strapping lugs.

14.11 Tapping Sleeves and Valves: Tapping sleeves shall be of the split sleeve

mechanical joint or "Hackensack" type, as required. Gate valves furnished with tapping sleeves shall be furnished in accordance with the above description of the gate valves, where applicable. Hub connections of the gate valves shall be mechanical joint. Tapping sleeves and valves shall be furnished as manufactured by A. P. Smith Manufacturing Company, Mueller or equal.

14.12 Concrete and Cement Mortar: Concrete of the respective classes for structures, manhole bottoms, bedding, encasement, and blocking shall conform to the provisions of Section 4 herein. Cement mortar for brickwork shall be made of one part Portland cement and two parts clean, sharp masonry sand.

14.13 Reinforcing Steel: Materials, fabrication and installation of reinforcing steel shall conform to the provisions of Section 5 herein, and to the details shown on the plans.

14.14 Miscellaneous Iron Castings: Materials, fabrication and installation of miscellaneous iron castings shall conform to the provisions of Section 5 herein and to the details shown on the plans.

14.15 Manhole Brick: Brick for manhole construction shall be whole, hard, burned common brick conforming in all respects to A.S.T.M. Specification, C62-75a Grade MA.

14.16 Corporation Stops: Corporation stops, where called for on the plans, or otherwise directed by the Engineer, shall be Mueller or approved equal in the sizes required.

14.17 Unloading, Hauling, Distributing and Storing Piping Materials: The Contractor shall furnish proper equipment and facilities for unloading, hauling, distributing and storing material.

(a) Hauling: Pipe, fittings and other materials shall be carefully handled so as to prevent breakage and so as to prevent damage to the lining in pipe and fittings. Pipe shall not be unloaded by rolling or dropping off of truck, or cars, but shall be handled by carefully lifting and lowering into position, using approved slings or clamps which shall be provided for the purpose.

(b) Distributing: Materials shall be distributed and placed so as to least interfere with traffic. No street or roadway may be closed without first obtaining permission of the proper authorities. The Contractor shall furnish and maintain proper warning signs and obstruction lights for the protection of traffic along streets and roadways, upon which material is distributed. Distributed materials shall not be placed in drainage ditches.

(c) Storage: All pipe, fittings, and other materials which cannot be distributed along the route of the work shall be stored for subsequent use when needed. The Contractor shall make his own arrangements for the use of storage areas except that he may make reasonable use of the Owner's storage yards.

14.18 Clearing: The Contractor shall perform all clearing work required for the installation of the complete work. Clearing shall consist of the removal and disposal of all pavement, trees, stumps, roots, brush, debris or other

such materials in the way of the work.

(a) Removal of Private or Public Facilities: Any private or public facilities, including fences, removed for construction purposes, shall be promptly replaced. Trees or shrubbery along roadways and streets shall not be disturbed unless absolutely necessary; subject to approval by the Engineer. Any such trees, or shrubbery, which may be necessary to be removed shall be heeled in and replanted. Heeling in and replanting shall be done under the direction of an experienced nurseryman.

All construction operations and all work necessary for performance of the contract must be confined within the Owner's property. The Contractor shall not trespass upon adjacent lands.

The Contractor, shall, by any other arrangements he may choose to make, provide any other land he may require for maintenance of construction facilities and equipment and for temporary storage of pipe line materials.

(b) Restoration of Grounds: The Contractor shall, as the work progresses restore the grounds to the same condition as existed before the work was done.

14.19 Location and Grade: Location and grade for the pipe line and the position of all fittings, outlets and appurtenances will be established by the Engineer, as may be required.

The Contractor shall provide such labor and assistance as the Engineer may request, and such hubs, stakes, spikes, nails and other fastenings as may be required in the prosecution of such layout work.

14.20 Organization of Work: The Contractor shall so organize his work that backfilling and cleanup shall closely follow pipe laying operations.

In general, not more than one block of a street or 500 foot of a road shall be closed for construction at any one time. Before proceeding with trenching operations in a succeeding block, the preceding section shall be backfilled, cleanup completed and the street opened to traffic.

For work outside of streets and roads, backfilling and windrowing, shall be performed in such manner that not more than 500 feet of trench shall remain open at any one time.

14.21 Protecting Existing Utilities and Structures: Any damage done to existing underground utility lines and service lines, to telephone, and power lines and poles, and to structures of every nature, including walls, steps, signs, drains, and cross-drains, etc., shall be promptly repaired or replaced by the Contractor at his expense. The approximate location of certain known underground lines and structures are shown on the plans for information only. Existing small lines are not shown. The Contractor shall locate these and other possible unknown utility lines by use of an electronic pipe and cable finder which he shall furnish and have available, in working order, at all times. All underground lines shall be located and exposed in advance of trenching operations.

Removing and relaying of utility lines and services which constitute an obstruction to the completed line and grade of the new work, in the opinion of

the Engineer, will be made at the expense of the Owner, unless otherwise shown on the plans to be altered by the Contractor.

In the water plant area several crossings of existing utilities are planned many of which are in rock. All planned crossings shall be excavated by hand prior to pipe line layout and extreme care used to prevent damage to these facilities during construction. Overhead power and control lines are adjacent to pipe line construction in several areas. Seasonally power lines which serve the remote high service pumping station can be temporarily removed from service. Extreme care shall be used to avoid damage to these facilities.

Failure on the part of the Contractor to comply with the above provisions in a reasonable manner, in the opinion of the Engineer, shall be sufficient cause for the Owner to order a temporary shutdown of further trenching and pipe laying operations until the provisions are complied with.

14.22 Bridging Open Trenches: Where trenches cross streets, walks, driveways and such other points as may be directed by the Engineer, the trenches shall be bridges as necessary, in an open and secure manner, so as to prevent any serious interruption of travel upon the roadway or sidewalks, and also to afford necessary access to public or private premises. The material used, and the mode of constructing said bridges, and the approaches thereto, must be satisfactory to the Engineer.

14.23 Construction Along Highways, Streets and Roadways: The Contractor shall install pipe lines on and along highways, streets and roadways in accordance with the applicable regulations of the State, County and City Highway and Street Departments with reference to construction operations, safety, traffic control, maintenance and repair, and in accordance with the following:

(a) Protection of Traffic: No highway, street or roadway shall be closed without first obtaining permission from the proper authorities. The Contractor shall provide suitable signs, barricades, lights and flagmen, as required, where traffic may be endangered by construction operations. All highway and street signs temporarily removed by reason of construction shall be promptly replaced as construction progresses.

(b) Construction Operations: The Contractor shall construct all work using the following sequence of operations, so as to least interfere with traffic:

(1) Stripping: Where pipe lines are laid along road shoulders or within the right-of-way, all sod, topsoil and other material suitable for shoulder or right-of-way restoration shall be stripped and stockpiled for later replacement.

(2) Trenching, Laying and Backfilling: Trenches shall not be opened any further ahead of pipe laying than is necessary for proper laying operations. Trenches shall be progressively backfilled and consolidated, and excess material removed immediately behind pipe laying operations.

(3) Shaping: Immediately after completing backfill operations, the Contractor shall re-shape damaged cut and fill slopes, side ditches and ditch lines and shall replace topsoil, sod and other materials

to the original condition and to the full satisfaction of the Engineer and other agencies having jurisdiction thereover.

(4) Personnel and Equipment: The Contractor will be required to provide adequate personnel and equipment so as to simultaneously carry out all of the above operations.

(c) Excavated Material: Excavated material shall not be placed in such manner as to interfere with traffic. No excavated material shall be allowed to remain on the pavement; all scattered material shall be broomed and swept away.

(d) Drainage Structures: All side ditches, culverts, cross drains and other drainage structures shall be kept clear of excavated material and be free to drain at all times.

(e) Maintenance: A road grader, or other suitable equipment, shall be furnished and be available at all times for maintenance work along the line of construction operations. Highways, streets and roadways shall be maintained in suitable condition for the movement of traffic until completion and final acceptance of the work. Private driveways that are cut or damaged shall be immediately repaired and maintained in similar fashion.

(f) Payment: No separate payment will be made for the above work. The cost of such work, and all costs incidental thereto shall be included in the unit prices bid for the item to which the work pertains.

14.24 Removing Pavement: The Contractor shall remove pavement as necessary for installing the new pipe lines and appurtenances and for making connections to existing pipe lines. Asphaltic concrete and concrete pavement shall be cut back from the top edges of ditch lines for a distance of at least nine (9) inches on each side of the ditch to allow for solid bearing edges for pavement to be replaced.

(a) Marking: Before removing any pavement, the pavement shall be marked for cuts neatly paralleling pipe lines and existing street lines. Asphalt pavement shall be broken along the marked cuts by use of jack hammer or other suitable tool. Concrete pavement and asphalt pavement on concrete base shall be scored to a depth of approximately 1-1/2 inches below the surface of the concrete along the marked cuts. Scoring shall be done by use of rotary saw, after which the pavement may be broken below the scoring by use of jack hammer or other suitable tool.

(b) Machine Pulling: No pavement shall be machine pulled until completely broken and separated along the marked cuts.

(c) Damage to Adjacent Pavement: The pavement adjacent to pipe line trenches must not be disturbed or damaged. If the adjacent pavement is disturbed or damaged, due to any cause such as caving ditch banks, indiscriminate use of construction machinery, etc., the Contractor shall remove the damaged pavement and shall replace it at his own expense.

(d) Payment: The removal and replacement of pavement will be paid for as a separate item, on the basis of measured quantity of pavement removed and replaced at the unit prices bid in the Proposal. Division Two work will be lump sum.

14.25 Trench Excavation: Excavation for trenches shall include the removal of all material of every description and of whatever substance encountered, to the depths and widths shown on the plans and specified herein, together with all pumping, bailing, draining, sheeting, bedding and such other work as may be required to permit pipe laying to proceed.

(a) Depth of Trenches: Trenches shall be excavated so as to provide for a minimum depth of cover of four (4') feet below the nearest pavement edge for pipe lines laid along or within the streets or roadways, and a minimum of three (3') feet of cover in other locations, except as otherwise provided for in these Specifications or shown on the Drawings.

(b) Width of Trenches: The widths of trenches from two feet over top of pipe and down, except where otherwise specified, shall be as follows:

Pipe Size	Max. Width	Min. Width
54"	6' - 6"	5' - 10"
42"	5' - 6"	4' - 10"
36"	5' - 0"	4' - 4"
30"	4' - 6"	3' - 10"
24"	4' - 0"	3' - 4"
20"	3' - 8"	3' - 0"
16"	3' - 4"	2' - 8"
12"	3' - 0"	2' - 4"
8"	2' - 8"	2' - 0"

(c) Extra Trench Depth: Where shown on the plans, or directed by the Engineer, trenches shall be excavated to depths in excess of those required to provide up to 3 feet of cover, when required to avoid interference with underground utilities and obstructions or to attain necessary grade.

(1) Payment: Payment for extra depths of cover will be made in accordance with the unit prices bid in the Proposal for the various sizes of pipe at the extra depths of cover stated.

(d) Bell Holes: Bell holes of ample depth and width shall be excavated in pipe trenches at the location of each joint to permit the joint to be properly made and to insure uniform bearing of the pipe barrel on the bottom of the trench.

(e) Bedding: In locations where pipe is to be bedded in earth excavated trenches, the bottom of such trenches shall be fine graded to allow firm and uniform bearing for the bottom of the pipe barrel on undisturbed earth. Where any part of the trench has been excavated below the grade of the trench, the part excavated below such grade shall be filled with compacted bank sand.

14.26 Trench Excavation in Rock: Rock excavation shall comprise solid rock in the original bed or in well defined ledges, the removal of which, in the opinion of the Engineer, requires drilling and blasting or the use of jackhammers or bullpoints. Concrete and masonry structures that require drilling and blasting for removal shall be considered as solid rock unless otherwise provided for herein. Boulders or detached pieces or rock having volumes of more than 8 cubic feet shall also be considered as solid rock.

Where rock is encountered at grade, the trench shall be excavated not less than 6 inches below the barrel of the pipe and refilled with thoroughly compacted crushed stone.

All rock excavated from trenches shall be hauled away and disposed of in locations arranged for by the Contractor, except that rock completely shattered into small fragments by blasting may be mixed with earth backfill when approved by the Engineer for specified locations.

(a) Payment: Rock excavation will be paid for at a unit price of fifteen and 00/100 ($15.00) Dollars per cubic yard as stated in the Proposal, such price to be in addition to that paid per foot of pipe line and to include the furnishing and placing of crushed stone to a depth of 6 inches below the barrel of the pipe, together with the hauling away and disposal of excavated rock. Rock excavation will be measured for payment for a width of trench equal to 4/3D plus 12 inches, where D is the nominal diameter of the pipe, the sides of trench being considered vertical, and to a depth of 6 inches below the barrel of the pipe. The minimum trench width for payment shall be 2 feet. Division Two work will be unclassified lump sum work and no separate payment will be made for rock.

14.27 Blasting: Blasting operations shall be conducted in strict accordance with existing ordinances and regulations and shall be done only after the Engineers approval of the method and quantity of the explosive to be used. All exposed structures shall be carefully protected from the effects of blast and all blasts shall be covered with heavy timbers, mats or other suitable material. Blasting shall be done only by experienced workmen. Any damage done shall be promptly repaired by the Contractor at his own expense. All blasting supplies shall be stored in a manner conforming with local laws regulating the storage of such materials. In no case shall blasting caps be stored at the place where dynamite or other explosives are stored. Blasting operation shall be conducted in strict accordance with Section 3 of these Specifications.

14.28 Dewatering Trenches: All excavation shall be dewatered properly before laying pipe. Where running sand is encountered, dewatering shall be done by well pointing whenever possible. Where soil conditions are not favorable for use of well point, french drains of graded stone shall be constructed to suitably located sumps and the water removed by bailing or pumping. All costs of equipment, labor and materials required for dewatering shall be included in the prices bid for pipe lines, or the lump sum bid for the water plant whichever applies.

14.29 Crushed Stone Stabilization: Wherever the subgrade is by nature too soft or mucky, in the opinion of the Engineer, for the proper installation of the pipe, he may order the Contractor to under cut the trench and backfill with crushed stone or gravel, 3/4-inch in size and less. The stone so placed shall be brought to the grade required for the particular location and compacted.

(a) Payment: Payment for crushed stone stabilization, only where ordered by the Engineer, will be made in accordance with the unit price bid for the item, measured before placing, and shall include the removal of excavated materials.

14.30 Bracing and Sheeting: The sides of trenches and excavation for structures shall be securely held by stay bracing, or by skeleton or solid sheeting

and bracing, as required by the soil conditions encountered, unless otherwise permitted by the Engineer. Timber bracing and sheeting shall also be used for the protection of other utilities and structures, as required.

Bracing and sheeting may be removed in units when the level of the backfilling has reached a point necessary to protect the pipe and adjacent property. When, in the opinion of the Engineer, sheeting and bracing cannot be safely removed, it shall be left in place.

(a) Payment: No extra payment will be made for timber bracing and sheeting except when ordered by the Engineer to be left in place, in which event it will be paid for in accordance with the unit price bid for the item in the Proposal.

14.31 Installation of Valves: Valves, in general, shall be installed and jointed as specified above for cast iron pipe and fittings. The installation of valves shall include the installation of valve boxes.

(a) Payment: Payment for the installation of valves will be made as a separate item based on the actual number of valves of various sizes installed at the unit prices bid in the Proposal.

14.32 Closing Pipe: When the work of pipe laying is suspended, either at night or at other times, the end of the pipe shall be closed with a suitable stopper or bulkhead to prevent entrance of foreign material into the pipe line.

14.33 Precaution Against Flotation: The Contractor shall take every precaution against floating of the pipe due to an accumulation of water in the trench before backfilling is completed. In event of flotation, the Contractor shall relay such pipe in a manner directed by the Engineer, making good at his expense any injury or damage to the pipe line which may result.

14.34 Concrete Blacking: Concrete blocking shall be formed and poured with Class "B" concrete in accordance with the details shown on the plans, at locations shown on the plans or as directed by the Engineer. In general, blocking shall be provided at the backs of hydrants, line fittings and outlets. Cast iron pipe struts shall be used with concrete blocking as required. Concrete blocking shall be poured against undisturbed earth having a bearing value of not less than 2,500 lbs. per square foot.

(a) Payment: Payment for concrete blocking will be paid for on the basis of actual quantity placed at the unit price bid in the Proposal, such price to include all costs of excavation, forming and furnishing and placing of concrete and furnishing pipe struts.

14.35 Installation of Blow-Offs and Air-Vents: Blow-offs and air vents shall be constructed in accordance with the details shown on the plans and at the locations indicated.

(a) Payment: Payment for blow-offs and air vents will be made in accordance with the following:

(1) Blow-Offs: In accordance with the lump sum prices bid in the Proposal for each blow-off connection. The lump sum shall include all cost of furnishing and installation of the blow-off as detailed on the plans and includes 6-inch gate valve, valve box, cast iron

pipe and fittings, retainer gland, splash pad and blocking.

(2) Air-Vents: In accordance with the lump sum prices bid in the Proposal for each size air-vent. The lump sum price shall include all costs for furnishing and installation of the air-vent as detailed on the plans and includes the air valve, piping, corporation stop, manhole, and manhole casting.

14.36 Connections to Existing Cast Iron Pipe Lines: Connections to existing cast iron pipe lines shall, in general, be made by the use of tapping sleeves and valves, except as specifically shown on the drawings to be otherwise, or as may be directed by the Engineer. The Contractor shall furnish the tapping sleeve and valve, the valve tapping machine, and all other equipment required for such installation. Tapping sleeves and valves shall be installed under the supervision of skilled mechanics.

(a) Location: The Contractor shall, before opening pipe line trenches, locate the various points of connections to be made into existing pipe lines and shall uncover as necessary for the Engineer to prescribe the types of connections and fittings to be installed.

(b) Interruption of Service: Connections to existing pipe lines shall be made only at such times and in such manner as will meet operating requirements. No cut shall be made in existing lines until the permission of the Superintendent of the Water Works has been obtained as to time and manner of making the cuts and connections. All existing valves shall be operated only by authorized representatives of the Owner.

(c) Payment: Payment for connections to existing lines will be paid for at the unit prices listed in the Proposal. The cost of pipe, fittings, valves, tapping sleeves and valves, concrete blocking and strapping will be paid for separately at the unit prices listed in the Proposal. The cost of connections to existing pipe lines and all cost incidental thereto except materials listed above shall be included in the unit price bid for the connection as listed in the Proposal.

14.37 Testing: When a section of pipe of a length deemed adequate by the Engineer is ready for testing, the line shall be thoroughly blown free from air and a leakage test made, and the Contractor shall furnish all labor, materials, and equipment for carrying out these tests. Wherever conditions will permit, in the opinion of the Engineer, pipe lines shall be tested before the trench is backfilled. All joints then shall be examined during open trench test and all leaks entirely stopped. The Contractor shall furnish a test pump and means for accurate measurement of water introduced into the line during testing.

(a) Temporary Bulkheads: The Contractor shall furnish, install, and remove all temporary bulkheads, flanges or plugs, to permit the required pressure tests, and shall furnish all equipment and labor to properly carry out such tests and to replace defective material.

(b) Test Pressure and Leakages: Test pressures shall be as directed by the Engineer. Leakage shall not exceed 5 gallons per inch of diameter per mile per 24 hours after all visible leaks have been repaired for 6 hours. However, if in the opinion of the Engineer additional testing is required, such additional testing shall be performed by the Contractor at no additional expense to the Owner.

(c) Defective Materials and Workmanship: Any cracked or broken material such as pipe, fittings, valves, or hydrants shall be removed and replaced with sound pieces, at the expense of the Contractor. Joints which leak shall be carefully remade. Remade joints and replaced material shall be retested under the same conditions of operations. If joints or materials are then found to be defective, they shall be remade and replaced until the line passes the required test.

14.38 Sterilizing Pipe Lines: All pipe lines and appurtenances, both existing and newly constructed, which have been exposed to contamination by reason of this construction, shall be sterilized after testing and flushing of the lines has been completed. Lines shall be filled with fresh water containing 50 parts per million of chlorine and allowed to stand for a period of 24 hours. Lines shall then be flushed until a chlorine residual of not more than 3 parts per million has been attained, at which time a sample shall be collected for bacteriological examination. Lines which do not show effective sterilization as determined from bacteriological examination shall be re-sterilized before being placed into service.

The Contractor shall furnish all labor, materials and equipment needed in the sterilization procedure. No extra payment will be made for sterilizing pipe lines, the cost thereof to be included in the unit prices bid for furnishing and installing pipe.

14.39 Backfilling: After pipes are laid and joints inspected trenches shall be backfilled and thoroughly compacted to a density equivalent to at least 95% of maximum density as determined by a Standard AASHO-T-99 Proctor Test. Should excavated material be unsuitable for backfill or compaction to required density the Contractor shall remove the unsuitable material and obtain and place suitable backfill material at the beginning of the job. A compaction test will be run by an independent testing laboratory to demonstrate that the Contractor's equipment and methods of backfill are suitable to accomplish the required density.

(a) Backfilling to a Height of Eighteen (18) Inches Above Pipe Barrel: Immediately after pipes are laid and joints inspected backfilling around the pipe and to a height of eighteen (18) inches above the pipe barrel shall be accomplished using selected backfill material consisting of finely divided earth, sand, crushed stone, pea gravel or other approved materials. The backfill material shall be carefully placed about the pipe and to the required height in uniform layers not exceeding six (6) inches in thickness. Each layer shall be thoroughly compacted with proper tools in a manner which will not disturb or injure the pipe. Backfilling shall be carried on simultaneously on both sides of the pipe to prevent injurious side pressures.

(b) Backfilling in Streets and Roadways shall be backfilled the full depth of the ditch as specified above. Compaction from 2-feet above the pipe to the top may be accomplished by suitable heavy-duty power tamping tools.

(c) Backfill Not Subject to Traffic may use general excavated material, from 2-feet above the pipe, provided such material is suitable for compaction to the required density and does not contain more than 1/3 broken rock, or which no single stone or boulder shall weigh more than 50 pounds. Backfill material shall be placed in uniform layers not exceeding 6 inches

in thickness; each layer shall be thoroughly compacted with heavy duty power tamping tools of the "Wacker" type. The use of power "Jumping Jack" tampers will not be permitted.

The Engineer may waive the requirements of power compaction of backfill upon written request from the Contractor, in which case, after placing the remainder of the backfill up to a level slightly below the natural ground surfaces, surplus excavation shall be windrowed and maintained in a suitable manner to concentrate and pond surface run-off from rains over the trench. After sufficient settlement has been obtained, in the opinion of the Engineer, the Contractor shall complete the dressing, remove surplus material, clean-up the surface in accord with these Specifications. Whenever the trenches have not been properly filled or if settlement occurs, they shall be refilled, smoothed off, and made to conform to the surface of the ground. Backfilling shall be carefully performed, and the original surface restored, to the full satisfaction of the property owner. Surplus material shall be disposed of as directed by the Engineer.

(d) Payment: Payment for removal of unsuitable backfill and replacement of suitable backfill material to meet density requirements shall be at unit prices bid in the "Extra Work if Ordered by Engineer" item in the Proposal. Compaction tests will be paid for by the Owner. All other work in this paragraph shall be included in the price bid for pipe or lump sum work whichever is applicable.

14.40 Replacing Unpaved Street Surfacing: Where water lines are constructed on unpaved streets, roads or driveways, the surfacing material shall be stripped and windrowed separately from the general material excavated from trenches. After the line has been installed and the backfill completed within 6 inches of the original street grade, the salvaged surfacing shall be replaced. This work shall be considered as general cleanup along with the removal of surplus excavation materials from the street surface and the restoring of the topsoil surfacing outside trench limits to its original condition, the cost of which shall be included in the unit prices bid for pipe lines.

14.41 Temporary Paving: Immediately after backfilling excavations subject to traffic, a 1-1/2 inch temporary asphalt surface shall be placed the full width of the removed paving and maintained to grade with existing paving until the permanent paving is placed.

14.42 Permanent Paving: Permanent paving replacement shall not be done until directed by the Engineer. Asphalt surfaced streets shall cut to a neat line at least 8-inches outside the ditch line and repaved with 8-inches of Class "B" concrete, bituminous prime coat, with 1-1/2-inches of sand-asphalt surface course. Cobble stone paving shall be hand placed in a sand cushion on an 8-inch Class "B" base extending 8-inches outside the ditch line. Voids between stones shall be filled with clean sand by sweeping and compacted with water.

14.43 Railroad Crossings: The Contractor shall furnish and install by one of the following methods, as permitted by the railroad, steel liner plates for the casing of either concrete or ductile iron carrier pipe.

(a) Open Cut Method: The railroad may allow the casing to be installed in open cut. If this method is used the railroad will remove rails and ties. The Contractor shall excavate, install the preassembled casing and

completely backfill the excavation to 95% compaction within one working day. The railroad shall not be out of service for more than 24-hours or the limit specified by the railroad.

(b) Tunneling Method: The method of tunneling shall conform with the best modern practice. Entry pits at tunnel ends shall be solid sheeted and braced. The Contractor shall take all precautions, and shall comply with all requirements as may be necessary to protect private or public property.

As the tunnel liner is installed, the voids between the exterior of the tunnel liner plates and the surrounding earth or rock surfaces shall be completely filled by pressure grouting. In no case shall more than fifty lineal feet of tunnel liner be installed without pressure grouting. If soil conditions warrants, or Engineer so directs, pressure grouting shall be performed at closer intervals. The carrier pipe shall then be installed to the line and grade shown on the drawings and blocked into position, (see details on drawings). Each end of the tunnel shall then be plugged with a masonry or concrete wall having a minimum thickness of 12-inches. Suitable weepholes, minimum 6-inches square, shall be provided in downstream plug wall near the flow line of the tunnel to afford drainage.

All excavation for pit and tunnel shall be unclassified.

14.44 Tunnel Liner Plates: Each tunnel shall be circular in section of the diameter as called for on the drawings. Casing for tunnels shall consist of tunnel liner plates of 12 gauge structural steel, either corrugated or of paneled out construction. After fabrication steel tunnel liner plates shall be hot dipped galvanized and, before delivery to jobsite, shall be fully bituminous coated for a minimum dry film thickness of 50 mils.

The price bid for tunnel shall include all necessary excavation and sheeting for pit, Railroad Protective Services, and all other miscellaneous materials and work required for a complete installation. Carrier pipe to be installed in tunnels shall be paid for at the unit price bid per lin. ft. of pipe installed.

(a) Railway Requirements:

(1) Interference with Railway Operations: The Contractor shall so arrange and conduct his work that there will be no interference with railroad operations, including train, signal, telephone, and telegraph service or damage to the property of the Railway Company or poles, wires and other facilities on the right-of-way. The Railway Engineer may take such precautions as he deems advisable to insure safety of trains or tracks.

(2) Watching and Flagging Protection: Any watching or flagging service required by the Railway Company for the safety of railroad operations, because of work being performed by the Contractor in connection therewith, will be provided by the Railway Company and the cost thereof shall be paid by the Contractor to the Railway Company.

(3) Damage by Railway Traffic: The Contractor shall assume all responsibility for any and all damage to his work, employees, equipment and materials, caused by operations to the Railway Company.

(4) Drainage Facilities: The Contractor shall preserve the effectiveness of any drainage facilities on Railway right-of-way or adjacent to tracks during his operations and leave them in as good condition and effectiveness as he found them.

(5) Insurance: The Contractor shall take out for the purpose of insuring against any and all risks of loss of life, personal injury, and property loss or damage, which may grow out of, or result from, or by reason of, or in connection with, said work or the acts of or operations of the Contractor, and maintain in full force and effect for the duration of the work, policies of insurance hereinafter specifically mentioned, said policies of insurance to be not less than the amount stipulated, as well as any other or additional insurance which should be taken out and maintained in force for or in connection with such work by the Contractor in compliance with any Federal, State, or Municipal law, statute or regulation, and furnish to the Owner, before commencing said work, the original of the policy, or duly certified copies of such insurance, or in lieu thereof, certificates from the underwriters of such insurance, viz:

a. Workmen's Compensation or Employer's Liability Insurance according to the laws of the State.

b. Contractor's Public Liability Insurance to protect the Contractor and subcontractors:

1. For loss of life or injury to persons in the amount of $1,000,000.00 for any one person and $1,000,000.00 for any one accident.

2. For property loss or damage in the amount of $1,000,000.00 for each accident and not less than $1,000,000.00 aggregate.

c. The original policy of Railroad Protective Liability Insurance naming the Railway Company as the insured, shall be designated as:

1. For loss of life or injury to person in an amount not less than $1,000,000.00 for any one person and not less than $1,000,000.00 for any one accident.

2. For property loss or damage in an amount not less than $1,000,000.00 aggregate. The Contractor shall comply with all special requirements of the Railway Company as related to Public Liability and Property Damage Insurance and shall furnish copies of certificates of coverage for such insurance taken out in favor of the said Railway Company, as well as copies of certificates for such insurance taken out in the name of the Contractor.

3. Indemnity: The Contractor shall indemnify and save harmless the Railway Company against any and all loss, or

damage to property of the Company and against claims, demands, suits, judgments, fines or sums of money accruing or claimed to accrue to any person, corporation, municipality, firm or company, against the Company, for any loss of life, or personal injury, or property loss or damage, whatsoever, or for violation of any municipal law or regulation, growing out of, or claiming to grow out of, any act or omission of or method pursued, or hazard encountered by the Contractor, or his agent, servant or employees engaged or employed in or about or in connection with the work to be done by the Contractor, and against any and all claims or liens which may be made or placed upon the said work by any laborer, materialman or furnisher, or any other person.

(b) Notification of Starting Work: The Contractor shall notify the Superintendent of the Railway Company, at least three days in advance when he will start work adjacent to tracks.

14.45 Measurement of Pipe Lines for Payment: Measurement for pipe lines for payment will be made along the center line of the pipe between center lines of terminal or other fittings and/or to points of connection with existing mains. No deductions in measured length will be made for lengths of valves or fittings.

14.46 Air Valves: Furnish and install air valves as shown on the drawings as manufactured by Crispin, APCO or approved equal.

14.47 Payment for Pipe Lines: Payment for pipe lines will be made in accordance with the unit prices bid in the Proposal which shall include the costs of furnishing and installing the pipe with a minimum cover of 3 feet. The cost of furnishing and installing any required closure sections or adapters for pressure concrete pipe or steel pipe, shall also be included in the unit prices bid for the pipe.

14.48 Acceptance of Work: Pipe lines and appurtenances will not be considered ready for acceptance until all provisions of these Specifications have been complied with, until all tests have been satisfactorily completed and until final inspection of all the work has been made. The Owner may put parts of the system in service before final acceptance.

Department of Natural Resources
ENVIRONMENTAL PROTECTION DIVISION
270 WASHINGTON STREET, S.W.
ATLANTA, GEORGIA 30334

JOE D. TANNER
Commissioner

J. LEONARD LEDBETTER
Division Director

October 12, 1976

Mayor and Council
City of Athens
City Hall
Athens, Georgia 30601

RE: Athens, Georgia - Water Works Expansion
Division One & Division Two

Gentlemen:

The revised plans and specifications for the above project, submitted by Wiedeman and Singleton, Engineers, have been reviewed and are approved by the Environmental Protection Division, Water Supply Section (for a nominal filtration rate of three (3) gallons per minute per square foot of filter area.)

The Water Quality Control Section of the Environmental Protection Division has reviewed the proposed handling of treatment plant sludges and they grant their approval with the following comment: At such a time when filter backwash discharges into the pond cause any increased solids loading to the North Oconee River, then steps must be taken to provide an additional solution.

Any deviations from the approved plans or specifications affecting capacity, hydraulic conditions, operating units, the functioning of water purification processes, or the quality of water to be delivered, must be approved by this Department before such changes are made.

This office is to be notified by letter when construction is to begin and the anticipated date of completion. Two (2) weeks prior to the actual completion, this office is to be notified so an inspection of the facility can be made by the Department.

We are retaining one copy of the approved plans and specifications for our files, sending one copy to you, and sending one copy to the engineers.

Very truly yours,

Ben M Carmichael for

Robert H. Byers
Program Manager
Water Supply Section

RHB:pg

cc: Wiedeman and Singleton
Clarke County Health Dept.

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